GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion
Lanier Technical College – TCSG 236
Dawsonville, Georgia

PROJECT MANUAL

Volume 1 – Divisions 0 thru 14

RELEASED FOR CONSTRUCTION

HKS

June 29, 2010
HKS 12528.000

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SEALS PAGE

ARCHITECT

HKS, Inc

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Atlanta, Georgia 30326

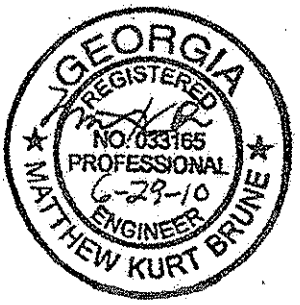


CIVIL ENGINEER

Ebberly & Associates, Inc.

1852 Century Plaza, Suite 202

Atlanta, Georgia 30345



STRUCTURAL ENGINEER

Walter P. Moore

1201 Peachtree Street, Suite 1600

Atlanta, Georgia 30301

MECHANICAL, ELECTRICAL, PLUMBING, FIRE PROTECTION ENGINEER

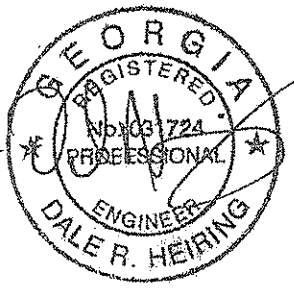
Nottingham, Brook & Pennington, Inc.

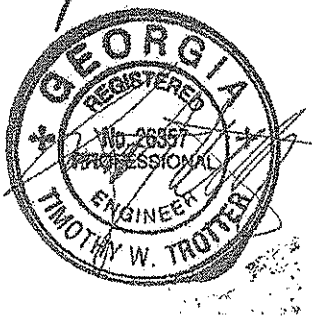
316 Corporate Parkway

Macon, Georgia 31210









GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

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SECOND COLUMN: DATE OF LATEST SECTION
THIRD COLUMN: REVISION NUMBER
"R" = Review Copy – Not For Construction / "0" = ORIGINAL / "#" = Revisions, Numbered Consecutively
FOURTH COLUMN: RESPONSIBLE CONSULTANT

HKS = HKS Inc.
GSF = Georgia State Financing and Investment Commission
E&A = Eberly & Associates
NB&P = Nottingham, Brook & Pennington, Inc..
WPM = Walter P. Moore

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SIXTH COLUMN: SPECIFICATION SECTION TITLE

VOLUME 1

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☒			GSF		Georgia-based Materials & Products Checklist
☒	06/23/09		GSF	CS-412	Supplementary General Requirements
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☒	06/29/10	0	HKS	01 3100	Project Management And Coordination
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☒	06/29/10	0	HKS	01 3300	Submittal Procedures
☒	06/29/10	0	HKS	01 4200	References
☒	06/29/10	0	HKS	01 4300	Quality Assurance
☒	06/29/10	0	HKS	01 4339	Visual Mock-up Requirements
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☒	06/29/10	0	WPM	01 4529	Structural Testing Laboratory Services
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☒	06/29/10	0	WPM	03 2000	Concrete Reinforcing
☒	06/29/10	0	WPM	03 3000	Cast in Place Concrete

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☒	06/29/10	0	WPM	05 3123	Steel Roof Decking
☒	06/29/10	0	WPM	05 3140	Steel Composite Deck
☒	06/29/10	0	HKS	05 4100	Cold-Formed Steel Framing
☒	06/29/10	0	HKS	05 4300	Slotted Channel Framing
☒	06/29/10	0	HKS	05 5000	Metal Fabrications
☒	06/29/10	0	HKS	05 5100	Metal Stairs
☒	06/29/10	0	HKS	05 5213	Pipe and Tube Railings
☒	06/29/10	0	HKS	05 7300	Ornamental Handrails and Railings

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☒	06/29/10	0	HKS	06 1643	Exterior Gypsum Sheathing
☒	06/29/10	0	HKS	06 4000	Architectural Woodwork
☒	06/29/10	0	HKS	06 4100	Custom Cabinets
☒	06/29/10	0	HKS	06 6813	Plastic Gratings

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☒	06/29/10	0	HKS	07 2617	Below Slab-On-Grade Vapor Retarder
☒	06/29/10	0	HKS	07 2726	Fluid-Applied Membrane Air Barriers
☒	06/29/10	0	HKS	07 4243	Composite Metal Wall Panels
☒	06/29/10	0	HKS	07 6113	Standing Seam Metal Roof Panels
☒	06/29/10	0	HKS	07 6200	Flashing and Sheet Metal
☒	06/29/10	0	HKS	07 8116	Cementitious Fireproofing
☒	06/29/10	0	HKS	07 8413	Penetration Firestopping
☒	06/29/10	0	HKS	07 8446	Fire Resistive Joint Firestopping
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☒	06/29/10	0	HKS	08 1416	Prefinished Flush Wood Doors
☒	06/29/10	0	HKS	08 3113	Access Doors and Frames
☒	06/29/10	0	HKS	08 3313	Overhead Coiling Counter Doors
☒	06/29/10	0	HKS	08 3326	Overhead Coiling Grilles
☒	06/29/10	0	HKS	08 3613	Sectional Overhead Doors
☒	06/29/10	0	HKS	08 4110	Interior Glazed Aluminum Partitions
☒	06/29/10	0	HKS	08 4213	Aluminum Entrance Doors
☒	06/29/10	0	HKS	08 4400	Glazed Aluminum Wall Systems
☒	06/29/10	0	HKS	08 7100	Door Hardware
☒	06/29/10	0	HKS	08 8000	Glazing
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☒	06/29/10	0	HKS	09 2900	Gypsum Board Assemblies
☒	06/29/10	0	HKS	09 3000	Tiling
☒	06/29/10	0	HKS	09 5113	Acoustical Panel Ceilings
☒	06/29/10	0	HKS	09 6115	Concrete Floor Sealer
☒	06/29/10	0	HKS	09 6500	Resilient Flooring
☒	06/29/10	0	HKS	09 6513	Resilient Base and Accessories
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☒	06/29/10	0	HKS	09 6800	Carpeting
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☒	06/29/10	0	HKS	09 9100	Painting
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☒	06/29/10	0	HKS	10 1100	Visual Display Surfaces
☒	06/29/10	0	HKS	10 1423	Panel Signage
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☒	06/29/10	0	HKS	10 2115	Cubicle Specialties
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☒	06/29/10	0	HKS	10 4116	Emergency Key Cabinets

☒	06/29/10	0	HKS	10 4400	Fire-Protection Specialties
☒	06/29/10	0	HKS	10 5113	Metal Lockers
☒	06/29/10	0	HKS	10 7500	Flagpoles

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☒	06/29/10	0	HKS	12 2413	Roller Window Shades
☒	06/29/10	0	HKS	12 3660	Solid Surfacing Countertops

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☒	06/29/10	0	HKS	14 4500	Vehicle Lift

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☒	06/29/10	0	NB&P	21 1100	Fire Suppression Piping
☒	06/29/10	0	NB&P	21 1300	Fire Suppression Sprinkler Systems
☒	06/29/10	0	NB&P	21 3000	Fire Pumps

DIVISION 22 - PLUMBING

☒	06/29/10	0	NB&P	22 0510	General Plumbing Requirements
☒	06/29/10	0	NB&P	22 0513	Motors for Plumbing Equipment
☒	06/29/10	0	NB&P	22 0519	Meters and Gages for Plumbing Piping
☒	06/29/10	0	NB&P	22 0553	Identification for Plumbing Piping and Equipment
☒	06/29/10	0	NB&P	22 0719	Plumbing Piping Insulation
☒	06/29/10	0	NB&P	22 1005	Plumbing Piping
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☒	06/29/10	0	NB&P	22 3000	Plumbing Equipment
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☒	06/29/10	0	NB&P	23 0514	Variable Frequency Controllers
☒	06/29/10	0	NB&P	23 0515	Enclosed Motor Controllers
☒	06/29/10	0	NB&P	23 0516	Expansion Fittings and Loops for HVAC Piping
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☒	06/29/10	0	NB&P	23 0553	Identification for HVAC Piping and Equipment
☒	06/29/10	0	NB&P	23 0593	Testing, Adjusting, and Balancing for HVAC

☒	06/29/10	0	NB&P	23 0713	Duct Insulation
☒	06/29/10	0	NB&P	23 0716	HVAC Equipment Insulation
☒	06/29/10	0	NB&P	23 0719	HVAC Piping Insulation
☒	06/29/10	0	NB&P	23 0913	Instrumentation and Control Devices for HVAC
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☒	06/29/10	0	NB&P	23 0994	HVAC Sequence of Operation
☒	06/29/10	0	NB&P	23 2113	Hydronic Piping
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☒	06/29/10	0	NB&P	23 2500	HVAC Water Treatment
☒	06/29/10	0	NB&P	23 3100	HVAC Ducts and Casings
☒	06/29/10	0	NB&P	23 3300	Air Duct Accessories
☒	06/29/10	0	NB&P	23 3413	Axial HVAC Fans
☒	06/29/10	0	NB&P	23 3423	HVAC Power Ventilators
☒	06/29/10	0	NB&P	23 3516	Engine Exhaust Systems
☒	06/29/10	0	NB&P	23 3600	Air Terminal Units
☒	06/29/10	0	NB&P	23 3700	Air Outlets and Inlets
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☒	06/29/10	0	NB&P	23 5533	Fuel-Fired Unit Heaters
☒	06/29/10	0	NB&P	23 6419	Reciprocating Water Chillers
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☒	06/29/10	0	NB&P	23 8101	Terminal heat Transfer Units
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☒	06/29/10	0	NB&P	26 0510	General Electrical Requirements
☒	06/29/10	0	NB&P	26 0519	Low-Voltage Electrical Power Conductors and Cables (600 V and Less)
☒	06/29/10	0	NB&P	26 0526	Grounding and Bonding for Electrical Systems
☒	06/29/10	0	NB&P	26 0529	Hangers and Supports for Electrical Systems
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☒	06/29/10	0	NB&P	26 0574	Electrical Testing
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☒	06/29/10	0	NB&P	28 3100	Fire Alarm System

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☒	06/29/10	0	E&A	31 2000	Earth Moving
☒	06/29/10	0	WPM	31 2300	Excavation and Fill
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☒	06/29/10	0	E&A	32 1313	Concrete Paving
☒	06/29/10	0	HKS	32 1413	Interlocking Precast Concrete Paving
☒	06/29/10	0	E&A	32 9200	Turf and Grasses
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☒	06/29/10	0	E&A	33 1100	Facility Water Distribution Piping
☒	06/29/10	0	E&A	33 3000	Sanitary Sewers
☒	06/29/10	0	E&A	33 4100	Storm Utility Drainage Piping
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(Design-Bid-Build)

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION

(OWNER)

For the Use and Benefit of

_____

(Using Agency/Institution)

FOR

PROJECT NO. -

(Project Name)

INCLUDES:
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Bid Requirements
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PAYMENT BOND	GSFIC-AD-102 (10-01-07)
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SAMPLE CHANGE ORDER FORM	GSFIC-AD-109 (10-01-07)
SAMPLE FORCE ACCOUNT AUTHORIZATION	GSFIC-AD-123 (10-01-07)
SUBCONTRACTOR EARLY RETAINAGE RELEASE CERTIFICATE	GSFIC-AD-110 (10-01-07)
MATERIAL COMPLETION CHECKLIST	GSFIC-CS-401 (10-01-07)
CERTIFICATE OF MANUFACTURER (Instructions)	GSFIC-AD-114 (10-01-07)
NON-INFLUENCE AFFIDAVIT	GSFIC-AD-111 (01-25-08)
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FINAL CERTIFICATION OF COSTS FOR CAPITAL ASSET ACCOUNTING	GSFIC-AC-202 (11-16-07)
DESIGN PROFESSIONAL'S CERTIFICATE OF MATERIAL COMPLETION	GSFIC-AD-116 (10-01-07)

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DESIGN PROFESSIONAL'S CERTIFICATE OF FINAL COMPLETION GSFIC-AD-119 (10-01-07)

Exhibit A Contractor Georgia Security and Immigration Compliance Act Affidavit
Exhibit B Georgia-Based Materials and Products Checklist

SUPPLEMENTARY GENERAL REQUIREMENTS

CONSTRUCTION CONTRACT

BETWEEN CONTRACTOR AND OWNER

THIS CONSTRUCTION CONTRACT ("Contract") made this _____ day of _____, 20 __, by and between _____, (hereinafter the "Contractor" or "Construction Professional"), whose address is _____, and the GEORGIA STATE FINANCING AND INVESTMENT COMMISSION, hereinafter called the "Owner," for the use and benefit of _____ , hereinafter called the "Using Agency".

WITNESSETH, that the Contractor and the Owner, for the consideration set forth herein, the adequacy and sufficiency of which is hereby acknowledged by each party, agree as follows:

Project No. _____

Project Name and Description: _____ (hereinafter the "Project.")

1. **Existing Documents.** The Contractor has reviewed and taken into consideration the Bidding Documents in preparing bid.

2. **Notice.** Notice in accordance with Section 1.1.5 shall be given to the following addresses:

CONTRACTOR:

Attention:
Phone Number: ( )- -
Facsimile Number: ( )- -

OWNER:

Georgia State Financing and Investment Commission
Attention:
270 Washington Street, S.E.
Atlanta, Georgia 30334
Phone No.: (404) 463-5600
Facsimile No.: (404) 463-5611

USING AGENCY:

Attention:
Phone Number: ( )- -
Facsimile Number: ( ) - -

DESIGN PROFESSIONAL:

Attention:
Phone Number: ( )- -
Facsimile Number: ( ) - -

3. **Representatives:** All notices sent to the Owner at the above address shall also be sent to the following respective Representatives. The following shall serve as the designated representatives established pursuant to Section 1.1.1.3.7:

OWNER'S REPRESENTATIVE: Georgia State Financing and Investment Commission.
270 Washington Street S.E.
Atlanta, Georgia 30334
Attention:
Phone Number: (404) 463-5600
Facsimile Number: (404) 463-5611

CONTRACTOR'S REPRESENTATIVE:

Attention:
Phone Number: ( ) - -
Facsimile Number: ( ) - -

4. **The Contract Sum:** The Owner shall pay the Contractor for the performance of the contract, subject to additions and deductions provided by approved change orders, in current funds, the Contract Sum as follows:

_____ Dollars (**$0.00**)

5. **The Material Completion Date shall be achieved within _____ consecutive calendar days beginning the date specified in the Proceed Order.**

6. **The agreed daily amount for Liquidated Damages is:** **$0.00** per day.

7. **Scope of the Work:** The Contractor shall furnish all the materials, perform all of the Work, and do all things required by the Contract Documents.

8. **Schedule and Completion:** The Pre-commencement Phase Services to be performed under this Contract shall commence upon the Effective Date of the Contract and be completed within 60 days thereafter. Activities on the Site shall commence on the date specified in the Proceed Order and shall be materially complete in accordance with established Milestones, and not later than the Material Completion Date.

9. **Energy Efficiency and Sustainable Construction Act of 2008.** This project [is] [is not] subject to the Energy Efficiency and Sustainable Construction Act of 2008 ("Energy Act"). Projects subject to the Energy Act require commissioning, water-use reduction, and use of not less than 10% of Georgia products.

10. **Periodic Progress Payments:** The Owner shall make progress payments, less retainage, as set forth in Section 4 of the General Requirements.

11. **Payment for Material Completion:** The Contractor may request payment of the remaining contract balance, including retainage, less amounts credited the Owner or incurred as liquidated damages, and less amounts withheld for the Punchlist by reason of Minor Items or Permitted Incomplete Work (See Section 6 Part 4). Payment for Material Completion shall be made by a check payable jointly to the Contractor and Surety and shall be mailed to the Surety.

12. **Final Payment:** Final Payment shall be made within ten days of receipt of the final payment application as set forth in Section 6, Part 6 of the General Requirements, provided that all other requirements of the Contract shall have been met in full.

13. **The Contract Documents**: This Contract, together with the Bidding Documents, the Bid and the General Requirements (including Forms and Exhibits) and any Supplementary General Requirements shall constitute the Contract Documents for the Project.

14. **Bonds:** The Contractor shall furnish both a performance bond and a payment bond and shall pay the premiums thereon as a Cost of the Work. The Performance Bond shall guarantee the full performance of the Contract.

15. Full Performance: The Owner and the Contractor hereby agree to the full performance of the Contract Documents.

16. Applicable Law: This Contract and all rights, privileges and responsibilities shall be interpreted and construed according to the laws of the State of Georgia.

17. No Conflict Of Interest: The Contractor covenants that it presently has no interest and shall not acquire any interest, direct or indirect, that would conflict in any manner or degree with the performance required under this Contract. The Contractor further covenants that, in the performance of this Contract, it shall neither contract with nor employ any person having any such interest.

18. Transactions With State Officials, Ethics: The parties hereto certify that the provisions of law contained in the Act prohibiting full-time appointive officials and employees of the State from engaging in certain transactions affecting the State as defined in O.C.G.A. §§45-10-20–26 and the Governor's Executive Orders governing ethics, have not and will not be violated in any respect in regard to this contract and further certifies that registration and all disclosures required thereby have been complied with.

19. No Assignment: This Contract and the proceeds of this Contract may not be assigned or sublet as a whole, nor may the performance thereunder be assigned, without the prior written consent of the Owner.

20. No Waiver: The failure of the Owner at any time to require performance by the Contractor of any provision hereof, shall in no way affect the right of the Owner thereafter to enforce any provision or any part of the Contract, nor shall the failure of the Owner to enforce any breach of any provision hereof to be taken or held to be a waiver of such provision, or as a waiver, modification or rescission of the Contract itself.

21. Georgia Security and Immigration Compliance Act Requirements. The Contractor hereby certifies its compliance with the Immigration Reform and Control Act of 1986 (IRCA), D.L. 99-603 and the Georgia Security and Immigration Compliance Act OCGA 13-10-90 *et seq.* Contractor certifies that Contractor has registered at https://www.vis-dhs.com/EmployerRegistration to verify information of all newly hired employees in order to comply with the Immigration Reform and Control Act of 1986 (IRCA), D.L. 99-603 and the Georgia Security and Immigration Compliance Act. Contractor further certifies that it shall execute any affidavits required by the rules and regulations issued by the Georgia Department of Labor set forth at Rule 300-10-1-.01 *et seq.* Contractor warrants that it has included a similar provision in all written agreements with any subcontractors engaged to perform services under this Contract. Contractor shall provide the Owner with notice of the identity of any and all subcontractors or consultants within five days of entering into the subcontract. The notice shall include an affidavit from the subcontractor or attesting to the subcontractor or consultant's name, address, user identification number, date of authorization to use the federal work authorization program and certification that the subcontractor or consultant shall verify the information of all newly hired employees.

22. Full Agreement: The Contract Documents supersede all prior negotiations, discussion, statements, and agreements between Owner and Contractor and constitute the full, complete, and entire agreement between Owner and Contractor. There can be no changes to this Contract by oral means, nor by course of conduct of the parties, nor by custom of the trade. No changes to this Contract will be binding on either party hereto unless such change is properly authorized, in writing, in accordance with Section 3, Part 2 of the General Requirements.

IN WITNESS WHEREOF the parties hereto have executed this Contract the day and year first written above.

CONTRACTOR

By: _____ (L.S)

Title: _____

ATTEST (affix seal over secretary's signature)
(If not a corporation, signature must be notarized.)

By: _____
Secretary of Corporation

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
OWNER

By: _____
Chairman, Governor Sonny Perdue

ATTEST (affix seal over signature)

By: _____
Steven L. Stancil, Director, Construction Division

BID REQUIREMENTS

INVITATION TO BID

[Note: The Invitation to Bid will be issued by the Owner under Standard Addendum A-1]

BID REQUIREMENTS

INSTRUCTIONS TO BIDDERS

1. **Basis of Contract.** Contract, if awarded, will be on a lump sum basis and will be substantially in accordance with the Contract shown on pages Contract – 1 to Contract – 4.

2. **Examination of Site.** In undertaking the work under this Contract, the Contractor acknowledges that he has visited the Project Site and has taken into consideration all observed conditions that might affect his work.

3. **Surety and Insurance Companies.** The Contract provides that the surety and insurance companies must be acceptable to the Owner. Only those sureties listed in the Department of Treasury's Listing of Approved Sureties (Department Circular 570) are acceptable to the Owner. At the time of issuance, all insurance and bonds must be issued by a company licensed by the Georgia Insurance Commissioner to transact the business of insurance in the State of Georgia for the applicable line of insurance. Such company shall be an insurer (or, for qualified self insurers or group self insureds, a specific excess insurer providing statutory limits) with an A.M. Best Financial Strength Rating of "A-" or better and with an A.M. Best Financial Size Category of Class V or larger.

4. **Bidding Documents.** The Bidding Documents comprise the Construction Documents, the Invitation to Bid, the Instructions to Bidders, the Bid Form, and all Addenda, upon which the bidder submits a bid.

5. **Addenda.** All Addenda issued prior to bid date adjust, modify, or change the drawings and specifications as set forth in the Addenda and all Standard Addenda issued by the Owner. No Addenda will be issued within five days of the date set for opening bids without an extension of the bid date. All such Addenda are part of the contract.

6. **Interpretations.** No oral interpretation will be made to bidders as to the meaning of the drawings and specifications. Requests for interpretation of drawings and specifications must be made in writing to the Design Professional not later than six days prior to the date set for receipt of the bids. Failure on the part of the successful bidder to request clarification shall not relieve him as Contractor of the obligation to execute such work in accordance with a later interpretation by the Design Professional. All interpretations made to bidders will be issued in the form of Addenda to the plans and specifications and will be sent to all plan holders of record. Acknowledgement of receipt of such Addenda and Standard Addenda shall be listed in the Bid Form by the Contractor.

7. **Alternates.** Unless otherwise stipulated, all alternate bids are deductive. It is in the best interest of the public, and the intent of the Owner is, that the entire Project be constructed within the funds allocated in the Project budget. The acceptance of any deductive alternate will be utilized as a last resort to accomplish the Project without requiring a redesign and rebidding of the Project. Any alternate, or alternates, if taken, will be taken in numerical sequence to the extent necessary.

8. **Sales Tax.** Unless otherwise provided for in the Contract Documents, the Contractor shall include in his bid all sales taxes, consumer taxes, use taxes, and all other applicable taxes that are legally in effect at the time bids are received.

9. **Trade Names, Specifications.**

(a) *No Restriction of Competition.* When reference is made in the Contract Documents to trade names, brand names, or to the names of manufacturers, such references are made solely to indicate that products of that description may be furnished and are not intended to restrict competitive bidding. If it is desired to use products of trade or brand names or of manufacturers' names that are different from those mentioned in the Bidding Documents, application for the approval of the use of such products must reach the hands of the Design Professional at least ten days prior to the date set for the opening of bids (*see* 9(b) below). This provision applies only to the party making a submittal prior to bid. If approved by Design Professional, the Design Professional will issue an addendum to all bidders. This provision does not prevent the Owner from initiating the addition of trade names, brand names, or names of manufacturers by addendum prior to bid.

(b) *Request for Approval of Substitute Product.* All requests for approval of substitution of a product that is not listed in the Bidding Documents must be made to the Design Professional in writing. For the Design Professional to prepare an addendum properly, an application for approval of a substitute product must be accompanied by a copy of the published recommendations of the manufacturer for the installation of the product together with a complete schedule of changes in the drawings and specifications, if any, that must

be made in other work in order to permit the use and installation of the proposed product in accordance with the recommendations of the manufacturer of the product. The application to the Design Professional for approval of a proposed substitute product must be accompanied by a schedule setting forth in which respects the materials or equipment submitted for consideration differ from the materials or equipment designated in the Bidding Documents.

(c) *Burden of Proof.* The burden of proving acceptability of a proposed product rests on the party making the submission. Therefore, the application for approval must be accompanied by technical data that the party requesting approval desires to submit in support of its application. The Design Professional will consider reports from reputable independent testing laboratories, verified experience records showing the reputation of the proposed product with previous users, evidence of reputation of the manufacturer for prompt delivery, evidence of reputation of the manufacturer for efficiency in servicing its products, or any other written information that is helpful in the circumstances. The degree of proof required for approval of a proposed product as acceptable for use in place of a named product or named products is that amount of proof necessary to convince a reasonable person beyond all doubt. To be approved, a proposed product must also meet or exceed all express requirements of the Contract Documents.

(d) *Issuance of Addenda.* If the Design Professional approves the submittal, an addendum will be issued to all prospective bidders indicating the approval of the additional product(s). Issuance of an addendum is a representation to all bidders that the Design Professional in the exercise of his professional discretion established that the product submitted for approval is acceptable and meets or exceeds all express requirements. If a submittal is initially rejected by the Design Professional, but determined to be acceptable to Design Professional after a conference with the Owner, an addendum covering the said submittal will be issued prior to the opening of bids. The successful bidder may furnish no products of any trade names, brand names, or manufacturers' names except those designated in the Contract Documents unless approvals have been published by addendum in accordance with the above procedure. Oral approvals of products are not valid.

(e) *Conference with the Owner.* Any party who alleges that rejection of a submittal is the result of bias, prejudice, caprice, or error on the part of the Design Professional may request a conference with a representative of the Owner, provided: that the request for said conference, submitted in writing, shall have reached the Owner at least six days prior to the date set for the opening of bids, time being of the essence.

10. **Employment of Georgia Citizens and Use of Georgia Products.** The work provided for in this Contract is to be performed in Georgia. It is the desire of the Owner that materials and equipment manufactured or produced in Georgia shall be used in the work and that Georgia citizens shall be employed in the work at wages consistent with those being paid in the general area in which the work is to be performed. This desire on the part of the Owner is not intended to restrict or limit competitive bidding or to increase the cost of the work; nor shall the fulfillment of this desire be asserted by the Contractor as an excuse for any noncompliance or omission to fulfill any obligation under the contract.

11. **Trading with the State Statutes, Ethics.** By submitting a bid, the bidder certifies that the provisions of law contained in O.C.G.A. Sections 45-10-20 to 45-10-71, which prohibit officials and employees of the state from engaging in certain transactions with the state and state agencies, and the Governor's Executive Orders governing ethics, have not and will not be violated in any respect in regard to this contract and further certifies that registration and all disclosures required thereby have been complied with.

12. **Georgia Security and Immigration Compliance Act Requirements.** No bid will be considered unless the Contractor certifies its compliance with the Immigration Reform and Control Act of 1986 (IRCA), D.L. 99-603 and the Georgia Security and Immigration Compliance Act OCGA 13-10-90 *et seq.* Contractor shall certify that Contractor has registered at https://www.vis-dhs.com/EmployerRegistration to verify information of all newly hired employees in order to comply with the Immigration Reform and Control Act of 1986 (IRCA), D.L. 99-603 and the Georgia Security and Immigration Compliance Act. The contractor shall execute the Georgia Security and Immigration Compliance Act Affidavit and submit this affidavit along with the bid. Contractor also agrees that it will execute any affidavits required by the rules and regulations issued by the Georgia Department of Labor set forth at Rule 300-10-1-.01 *et seq.* If the Contractor is the successful bidder, contractor warrants that it will include a similar provision in all written agreements with any subcontractors engaged to perform services under the Contract.

13. **Owner's Policy Statement.** The policy of the Owner is that minority business enterprises shall have the maximum opportunity to participate in the Owner's purchasing process. The Owner encourages all minority business enterprises to compete for, win, and receive contracts for goods, services, and construction. In addition, Georgia law provides a state income tax credit available to any business that subcontracts with a minority-owned business. [*See* O.C.G.A. §48-7-38 and O.C.G.A. §50-5-130. *See also* Executive Order of the

Governor No. A-11-0002-1992.] Any questions regarding statements contained hereunder should be directed to the minority vendor designee specified in the Supplementary General Requirements.

14. **Bids.**

(a) *Bid Opening.* Bids will be opened and announced as stated in the Invitation to Bid.

(b) *Bid Submission.* All bids must be submitted on the Bid Form as attached hereto and must be signed, notarized, and sealed by a notary public. All blanks for information entry in bid forms submitted to Owner should be filled. Blanks left unfilled constitute irregularities in the bid and place the bidder at risk of having the bid rejected *unless* the Owner rules the irregularity to be an informality or technicality that the director can waive, as is made clear in Paragraph 15 of these "Instructions to Bidders" and on the Bid Form. Numbers shall be written in English words and in Arabic numerals. The inclusion of any condition, alternate, qualification, limitation, or provision not called for shall render the bid non-responsive and shall be sufficient cause for rejection of a bid.

(c) *Bid Security.* Bids must be accompanied by a Bid Bond made payable to the Owner in an amount not less than five percent of the Bid. Bid Bonds should be furnished on forms accepted as standard by the insurance industry, but shall be substantially in accordance with the Bid Bond Form attached hereto.

(d) *Delivery of Bids.* Bids are to be addressed to the Owner, at the address and room number shown in the Invitation to Bid. Bids must be enclosed in an opaque, sealed envelope; marked with the Bid Date, Bid Time, Bid Number, Name of Project; and identified with the words "Bid for Construction." Bids must be placed in the hands of the Owner at the specified location by not later than the hour and date named in the Invitation to Bid. After that time, no bids may be received.

(e) Alternates. A bid must be submitted for all specified alternates, if any. Failure to do so may render the bid non-responsive and be sufficient cause for rejection of a bid.

(f) *Withdrawal of Bids.* Bids may be withdrawn by bidders prior to the time set for official opening. After time has been called, no bid may be withdrawn for a period of thirty-five days after the time and date of opening except as provided in O.C.G.A Section 13-10-22 (appreciable error in calculation of bid). Negligence or error on the part of any bidder in preparing his bid confers no right of withdrawal or modification of his bid after time has been called except as provided by Georgia law.

15. **Contract Award.** Award shall be made on a lump sum basis to the lowest responsive and responsible bidder. The lowest bid will be the bid whose price, after incorporating all accepted alternates, is the lowest responsive bid that was received from a responsible bidder. No bid may be withdrawn for a period of thirty-five days after time has been called on the date of opening except in accordance with the provisions of law.

16. **Owner's Rights Concerning Award.** The Owner reserves the right in its sole and complete discretion to waive technicalities and informalities. The Owner further reserves the right in its sole and complete discretion to reject all bids and any bid that is not responsive or that is over the budget, as amended. In judging whether the bidder is responsible, the Owner will consider, but is not limited to consideration of, the following:

(a) Whether the bidder or its principals are currently ineligible, debarred, suspended, or otherwise excluded from bidding or contracting by any state or federal agency, department, or authority;

(b) Whether the bidder or its principals have been terminated for cause or are currently in default on a public works contract;

(c) Whether the bidder can demonstrate sufficient cash flow to undertake the project as evidenced by a Current Ratio of 1.0 or higher;

(d) Whether the bidder can demonstrate a commitment to safety with regard to Workers' Compensation by having an Experience Modification Rate (EMR) over the past three years not having exceeded an average of 1.2; and

(e) Whether the bidder's past work provides evidence of an ability to successfully complete public works projects within the established time, quality, or cost, or to comply with the bidder's contract obligations.

17. **Owner's Right to Negotiate with the Lowest Bidder.** In the event *all* responsive and responsible bids are in excess of the budget, the Owner, in its sole and absolute discretion and in addition to the rights set forth above, reserves the right either to (i) supplement the budget with additional funds to permit award to the lowest responsive and responsible bid, or (ii) to negotiate with the lowest responsive and responsible bidder (after taking all deductive alternates) only for the purpose of making changes to the Project that will result in a cost to the Owner that is within the budget, as it may be amended.

18. **Contract Forms.** The contract forms, including the payment and performance bonds, shall be as set forth in the General Requirements, Section 7 – Forms and Exhibit "A".

BID FORM

[Note: The Bid Form will be issued by the Owner under Standard Addendum A-1]

STATEMENT OF BIDDER'S QUALIFICATIONS:

[Note: The Statement of Bidder's Qualifications form will be issued by the Owner under Standard Addendum A-1]

BID BOND

[The Bid Bond form will be issued by the Owner under Standard Addendum A-1]

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APPLICATION FOR PAYMENT	GSFIC-AD-105 (01-03-08)
SAMPLE CHANGE ORDER FORM	GSFIC-AD-109 (10-01-07)
SAMPLE FORCE ACCOUNT AUTHORIZATION	GSFIC-AD-123 (10-01-07)
SUBCONTRACTOR EARLY RETAINAGE RELEASE CERTIFICATE	GSFIC-AD-110 (10-01-07)
MATERIAL COMPLETION CHECKLIST	GSFIC-CS-401 (10-01-07)
CERTIFICATE OF MANUFACTURER (Instructions)	GSFIC-AD-114 (10-01-07)
NON-INFLUENCE AFFIDAVIT	GSFIC-AD-111 (01-25-08)
STATUTORY AFFIDAVIT	GSFIC-AD-112 (01-25-08)
FIVE YEAR BOND ON ROOFS AND WALLS	GSFIC-AD-113 (11-16-07)
BOND TO DISCHARGE CLAIM	GSFIC-AD-118 (10-01-07)
FINAL CERTIFICATION OF COSTS FOR CAPITAL ASSET ACCOUNTING	GSFIC-AC-202 (11-16-07)
DESIGN PROFESSIONAL'S CERTIFICATE OF MATERIAL COMPLETION	GSFIC-AD-116 (10-01-07)
USING AGENCY'S CERTIFICATE FOR MATERIAL COMPLETION AND OCCUPANCY	GSFIC-CS-402 (10-01-07)
DESIGN PROFESSIONAL'S CERTIFICATE OF FINAL COMPLETION	GSFIC-AD-119 (10-01-07)

Exhibit A GEORGIA SECURITY AND IMMIGRATION COMPLIANCE ACT AFFIDAVIT

SUPPLEMENTARY GENERAL REQUIREMENTS

SECTION 1 – GENERAL

PART 1 - GENERAL

1.1.1 General Provisions.

1.1.1.1 This Contract and Affiliated Agreements – Requirement for Written Agreements. Affiliated Agreements are any agreement required by this Contract or deemed necessary, efficient, or expedient by Contractor, between the Contractor and any party other than the Owner. All Affiliated Agreements, including any subsequent modifications, must be in writing, dated, and executed by the parties. Affiliated Agreements, including financial arrangements with respect to this Project, must be promptly and fully disclosed to the Owner upon their execution or modification.

1.1.1.2 Basic Statement of Owner Objectives. The Owner's basic objectives are the construction of the Project within the limits, time, and funds available to Owner for construction of the Project, and in accordance with the approved Construction Documents.

1.1.1.3 Project Team. To accomplish Owner's objectives, Owner intends to employ a team concept in connection with the construction of the Project. The basic roles and general responsibilities of team members are set forth in general terms below but are more fully set forth in the Design Professional Contract with respect to the Design Professional, in the Program Management Agreement with any Program Manager, and in this Contract with respect to the Contractor.

1.1.1.3.1 Relationship of Parties. The Owner and the Contractor agree to proceed with the Project on the basis of trust, good faith, and fair dealing and to cooperate fully with each other. The Owner and the Contractor shall do all things reasonably necessary to perform this Contract in an economical and timely manner, including without limitation, consideration of design modifications to enhance constructability and alternative materials or equipment, if considered necessary or convenient by the Owner. The Contractor agrees to procure or furnish, as permitted by the laws of Georgia, all Pre-Commencement phase services and construction phase services as set forth herein. The Owner shall endeavor to promote harmony and cooperation among the Owner, Program Manager, Design Professional, Contractor and other persons or entities employed by the Owner for the Project.

1.1.1.3.2 Design Professional. The Design Professional is retained in accordance with the Design Professional Contract (i) for the design and preparation of Construction Documents that are necessary to implement the Program governing the construction of the Project or Components thereof, and the design and preparation of any necessary documents antecedent to preparation of such Construction Documents, or (ii) for construction contract administration of the Work under Contract Documents, or (iii) for both. The Contractor acknowledges and agrees that the Contract Documents are addressed to skilled tradesmen in the construction profession who shall be required to use their special skills and experience, through submittals and shop drawings, to translate the Design Professional's design intent as expressed in the Contract Documents into a completed structure. The Contract Documents shall specify when shop drawings or submittals require the seal of a specialty consultant.

1.1.1.3.2.1 The basis of the Owner's engagement of the Design Professional is the "Design Professional Contract." The Contractor is advised that both the Owner and the Design Professional have on file, at their respective places of business, copies of that executed agreement. The Design Professional is not the agent of the Owner, except to the extent so specified in writing, but is employed as a consultant to the Owner to assist the Owner in determining if the conditions of the contract have been met. All decisions of the Design Professional on matters of aesthetics are final, conclusive, and binding on all parties if consistent with the requirements of the Contract Documents.

1.1.1.3.2.2 The Contractor promptly shall request and review a copy of the Design Professional Contract during the Pre-commencement Phase and shall become familiar with the respective services, authorities, obligations, and responsibilities of the parties therein. Contractor agrees to develop a working relationship with the Design Professional to effectuate the purposes of the Project

in accordance with the terms of this Contract and with consideration of the Design Professional's responsibilities under the Design Professional Contract.

1.1.1.3.2.3 The Contractor acknowledges that the respective contracts require the Owner and the Design Professional to proceed with the Project on the basis of trust, good faith, and fair dealing, and they will take all actions reasonably necessary to ensure the Project proceeds to completion within the Owner's time and budgeting constraints. The Contractor also acknowledges that the Design Professional is to perform all tasks and services required of it under the Design Professional Contract. The Contractor further acknowledges that, in order for the Design Professional to perform its obligations, the Design Professional requires certain materials, information, or other submittals pursuant to the Contract Documents from the Contractor. The Contractor agrees to provide the Design Professional with the submittals required by the Contract Documents. The Contractor further agrees to cooperate with the Design Professional to ensure timely completion of all obligations under this Contract to complete the entire Project.

1.1.1.3.2.4 Contractor agrees that the services provided by the Design Professional under the Design Professional Contract are intended to coordinate and complement, but not to diminish, alter or substitute for, any of the services, authority, obligations, or responsibilities of the Contractor under this Contract. Contractor further agrees that the performance of services by the Design Professional in connection with the Project shall in no way relieve Contractor from any of its services, authority, obligations, or responsibilities under this Contract, and shall not alter or diminish those services, authority, obligations, or responsibilities in any way whatsoever.

1.1.1.3.3 Program Manager. Owner may designate a Program Manager to administer the Project and this Contract. In lieu of a Program Manager, Design Professional may be designated to perform the role of Program Manager. The Program Manager may also be designated as the Owner's Representative, and if no Owner's Representative is designated, the Program Manager shall be the Owner's Representative.

1.1.1.3.4 Owner's Representative. Owner shall from time to time in writing designate one person as Owner's Representative under this Contract. For further definition, *see* Paragraph 3 of the Contract and Section 1.1.9.39.

1.1.1.3.5 Using Agency, Using Agency's Representative. The Project is intended for the benefit of the Using Agency. A copy of all matters submitted to Owner shall also be submitted to Using Agency for Using Agency's information. The Using Agency may designate one or more representatives to participate with Owner in Owner's activities under this Contract. Neither the Using Agency nor any representative of Using Agency shall have any authority to act for or in the name of the Owner. Participation in the Project by Using Agency or its representative(s) shall be solely advisory to the Owner. The Program Manager, Design Professional, Contractor, or any Separate Contractor must not act or rely solely upon any directive, interpretation, decision, act, or omission of Using Agency or the Using Agency's Representative.

1.1.1.3.6 Owner's Contract Compliance Specialist (CCS). Owner may from time to time in writing designate a person or firm as Owner's Contract Compliance Specialist under this Contract. The Owner's Contract Compliance Specialist may be hired by Owner or hired under the Program Manager's Contract or the Design Professional's Contract and shall provide inspection services of the Work on behalf of the Owner. The presence of an Owner's Contract Compliance Specialist does not relieve the Contractor of any of its responsibilities for quality control and independent testing set forth in the General Requirements. The Owner's Contract Compliance Specialist has the authority to report any deviations from the Contract Documents directly to the Contractor's superintendent at the job site for immediate action, and also to report same to the Program Manager or Design Professional, and Owner.

1.1.1.3.7 Representatives. The designated representatives of the Contractor and the Owner shall have full authority to act (other than for the receipt of notices that must be given as specified in Paragraph 1.1.5) in matters relating to this Contract until notice is given that such authority has been revoked. Contractor and the Owner may each rely upon the written certification of the other as to the appointment of a designated representative or the revocation of his authority. The Contractor shall designate, in writing, a representative authorized to act on the Contractor's behalf with respect to the Project. The Contractor's initial authorized representative shall be the Project Superintendent of the Contractor as identified by the Contractor. Contractor shall employ the Project Superintendent and necessary assistants who shall be in attendance at the Site during the progress of the Work. The Contractor's designee shall represent Contractor. All written communications given to the Contractor's designee shall be binding upon Contractor.

1.1.1.3.8 Separate Contractor. Owner may select one or more Separate Contractors to perform work with respect to the Project or Components thereof. The Contractor shall afford the Owner's Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities and shall coordinate the Separate Contractors' schedules with those of the Contractor. The Owner's Separate Contractors shall adhere to the Contractor's work rules, schedule, laydown areas, and safety requirements.

1.1.1.3.9 Commissioning Authority. The Owner, Design Professional, or the Using Agency may select and engage a Commissioning Authority to perform building commissioning activities and monitor testing activities. The Commissioning Authority shall perform and coordinate and accomplish its work as set forth in Sections 1.3.4 and 2.1.7.

1.1.2 Project Team, Cooperation, Partnering.

1.1.2.1 Concept. It is the Owner's expectation that the Program Manager, Design Professional, Owner, Using Agency, Contractor, and any Separate Contractor, shall work as a Project Team to effect the commencement of and completion of construction in accordance with the Project Schedule, and to achieve Material Completion and Final Completion of the Project. Each team member shall communicate with all other team members to assure overall coordination, cooperation, and efficiency. Each team member shall cooperate fully with and coordinate fully with each other team member in order to achieve Project completion in an expeditious and economical manner. The Contractor shall schedule regular meetings of the key principals of the Project Team in an effort to solve problems in a partnering atmosphere to facilitate the ability of each team member to meet its business objectives, so long as its business objectives are consistent with the successful completion of the Project. It is the Owner's intent that all consensus decisions of the Project Team, where differing from the Contract Documents, be expeditiously resolved and, if Owner agrees, an appropriate Change Order will be issued.

1.1.2.2 Conference. Promptly after the execution of this Contract, Contractor shall confer with the Program Manager, Design Professional, Owner, and Using Agency to identify personnel and relevant organizational charts of each team member, and to establish working relationships with each team member.

1.1.2.3 Authority of Contractor. Contractor is, and at all times during the term of this Contract shall be, an independent contractor in the performance of its duties and obligations under this Contract. Contractor shall have no authority to bind or otherwise obligate Owner, orally, in writing or by any acts, unless specifically authorized by Owner in writing. Nothing contained in this Contract shall constitute or be deemed or construed to create a partnership or joint venture, or any agency relationship, between Owner and Contractor.

1.1.2.4 Team Evaluation Process, Covenant not to Sue. If Team Evaluation is elected as part of this Contract, all team members agree to participate in good faith in the State of Georgia's formal Team Evaluation Process [copies of which will be made available to any bidder on request]. By executing this agreement for construction services with the Owner, the Contractor waives any and all legal rights for defamation, libel or slander and covenants not to sue the State of Georgia, the Owner, the Design Professional, the Using Agency, other team members, and their respective representatives and

agents for comments, rankings, and results related to the Contractor's performance posted in good faith as a part of, and in accordance with, said Team Evaluation Process. The Design Professional and other team members, in their agreements with the Owner, have executed, or will execute, a similar agreement.

1.1.3 Constitutional Principles Applicable to State Public Works Projects.

1.1.3.1 Title to Project Site. Title to the Site is vested in the State of Georgia as public property of the State of Georgia, and is not subject to levy or lien.

1.1.3.2 Title to Improvements and Delivered Materials. Title to all improvements constructed at the Site vests *instanter* in the State of Georgia. Title to all materials vests in the State of Georgia upon their delivery without rejection by the Contractor at the Site, regardless of the status of payment or nonpayment of the costs thereto. Protection of laborers and Suppliers (regarding payment for services and materials) is effected through the provision of payment and performance bonds by the State.

1.1.3.3 Limited Waiver of Sovereign Immunity *Ex Contractu*. Contractor acknowledges and agrees that Owner is an agency or instrumentality of the State of Georgia, and as such is entitled to the protection of sovereign immunity. As set forth in Article I, Section II, Paragraph IX of the 1983 Georgia Constitution, sovereign immunity is waived "as to any action *ex contractu* for the breach of any written contract." Contractor specifically acknowledges the constitutional and contractual requirements that written changes, modifications, and waivers to this Contract must be specifically executed by the Owner as set forth in the Contract Documents. Accordingly, Contractor specifically acknowledges the constitutional prohibitions against claims against Owner based solely upon oral statement, course of conduct, customs of the trade, quasi-contract, *quantum meruit*, or O.C.G.A § 13-4-4 (mutual departure from contract terms).

1.1.3.4 Limitations upon Authority of Agents. Contractor further acknowledges that Owner is an agency or instrumentality of the State of Georgia, and as such acts through specific public officials. The legal concepts of agency applicable to the Owner are solely as set forth in O.C.G.A. §45-6-5 and as further specified in the Contract Documents. Contractor specifically acknowledges the statutory and contractual requirements that written changes, modifications, and waivers to this contract must be executed only by the identified representatives of Owner as set forth in the Contract Documents. Accordingly, Contractor specifically acknowledges that any claims against Owner based upon the act of any non-authorized employee or official are invalid.

1.1.3.5 U.C.C. Not Generally Applicable. Contractor further acknowledges and agrees that Owner, as set forth in subsection (3) above, has granted only a limited waiver of sovereign immunity, such that the provisions of the Uniform Commercial Code (O.C.G.A §11-1-101 through §11-2-725) governing sales of goods do not apply to this Contract. Contractor specifically acknowledges the contractual requirements that written changes, modifications, and waivers to this contract must be specifically executed by the Owner as set forth in the Contract Documents. Accordingly, Contractor specifically waives and covenants not to make against Owner any claims based upon the Uniform Commercial Code. Contractor understands, however, that Contractor's subcontracts with Suppliers and Subcontractors may in fact include sales of goods and therefore be properly governed by the Uniform Commercial Code; nonetheless Contractor covenants that any such application shall in no way be construed to have any legal effect upon this contract between Owner and Contractor.

1.1.4 Third Party Beneficiary. Contractor acknowledges, stipulates, and agrees that the Owner is a public department, agency, or commission of the executive branch of government of the State of Georgia performing an essential public and governmental function by means of the Contract. Contractor acknowledges, stipulates, and agrees that the Using Agency is an express third party beneficiary of this Contract. There are no individual or personal third party beneficiaries of this Contract.

1.1.5 Notice.

1.1.5.1 General Requirement. Any official notice, election, demand, consent, approval, change order, amendment, or other material communication required or permitted to be given under this Contract shall be in writing signed by an officer or duly authorized representative of the party making same and shall be delivered personally or shall be sent by certified or statutory mail, postage prepaid, return receipt requested, shall be effective as of the date on which it is received or would have been received but for the refusal of the addressee to accept delivery, and shall be addressed as shown in the Contract. The persons and addresses to which notices should be given may be changed by notice given in accordance with this Section.

1.1.5.2 Copies of Notices to Owner. Wherever the Contract Documents provide that a copy of any notice, request, or demand filed with the Design Professional by the Contractor shall be furnished to the Owner, such notice, request, or demand shall not become effective until the Owner has received his copy. No notice in writing or given orally to the Design Professional or to the Contract Compliance Specialist is notice to the Owner unless copy of the aforesaid notice in writing shall have been properly served upon the Owner at the address shown in the Contract.

1.1.6 Liquidated Damages.

1.1.6.1 Time of the Essence. Time being of the essence of this Contract, and a material consideration thereof, it is mutually agreed by the parties hereto in case of the Contractor's failure to complete the construction within the time specified, the Owner will be damaged thereby. The Contractor shall commence performance of its activities on the Site under this Contract within five calendar days of the date specified in the Proceed Order. The Contractor shall complete construction, except for Minor Items and Permitted Incomplete Work (*see* Section 6.1.2), not later than the Material Completion Date, as adjusted by Change Order.

1.1.6.2 Liquidated Damages. Because it is difficult to definitely ascertain and prove the amount of said damages, inclusive of, but not limited to, expenses for inspection, superintendence, loss of use, and necessary traveling expenses, the Owner, Contractor, and Using Agency hereby agree that the amount of such damages shall be the daily rate specified in the Contract, beginning upon the contractually required Material Completion Date and ending on the date that the Certificate of Material Completion is issued. The parties agree that the specified Liquidated Damages are not established as a penalty but are calculated and agreed upon in advance as a fair and equitable amount reasonably estimated in advance to cover losses to be incurred by the Owner and Using Agency for such delay or interruption in view of the uncertainty and impossibility of ascertaining actual damages that would be incurred.

1.1.6.2.1 Contractor Agrees to Pay. The Contractor agrees to pay the amount, computed by multiplying the Liquidated Damages set forth in the Contract by the number of days between the contractually required Material Completion Date and the date that the Certificate of Material Completion is issued.

1.1.6.2.2 Deducted as They Accrue. Liquidated Damages shall be deducted from periodic payments as they accrue and such deduction shall be in addition to the retainage provided for in the Contract. The remaining balance of any Liquidated Damages shall be deducted from the Payment for Material Completion to the Contractor or its Surety. If the unpaid balance of the Contract Sum is less than the total amount to be deducted for Liquidated Damages as herein above provided, the Contractor shall promptly pay to the Owner, upon the Owner's demand, the amount by which such sum exceeds the unpaid balance of the Contract Sum.

1.1.6.3 Limitation on Owner's Damages. Except as otherwise set forth in the Contract Documents, damages of the Owner and Using Agency for delay shall be limited to the Liquidated Damages as defined herein. Nothing in this Section 1.1.6 shall be construed to limit Owner's right to pursue damages or remedies for claims against the Contractor for reasons other than delay.

1.1.7 Documents.

1.1.7.1 Order of Precedence of Documents and Changes. The Contract Documents are to be taken as a whole and are intended to be complimentary with one another. It is also intended that they include all items necessary for the proper execution and completion of the Work. If a conflict exists between or within the Contract Documents, or if they are inconsistent, the provisions of any Change Order added hereto after the date of this Contract shall control over any contrary terms contained in the Contract Documents existing at the time of this Contract. In the event of conflict amongst the Contract Documents, a Change Order shall control over any previous Change Order; a Change Order shall control over the Supplementary General Requirements, which shall control over the Form of Contract, which shall control over the General Requirements. (*See also* Section 1.1.7.1)

The Design Professional has no authority to amend the Contract Documents, orally or in writing, either expressly or by implication.

1.1.7.2 Copies of Contract Documents to Contractor. Without charge to the Contractor the Design Professional shall furnish to the Contractor up to twenty-five sets of completed Contract Documents in hardcopy, one set of reproducible and electronic background floor and reflected ceiling plan drawings and, if requested, one copy in read-only electronic format. The Contractor may obtain such additional sets of Contract Documents, as the Contractor deems necessary and shall pay the cost of reproduction of such additional sets to the Design Professional.

1.1.7.3 Marked-Up ("As-Built") Documents. Prior to Final Completion, the Contractor shall provide one complete set of Marked-Up Documents to the Design Professional. The Marked-Up Documents shall consist of the Contract Documents annotated and changed to reflect the as-built condition of the Project, including all Change Orders, field instructions, answers to RFI's, clarifications, sketches, delegated contractor design drawings (e.g. Performance Specifications requiring the seal of a Specialty Consultant) and locations of utilities and other hidden elements.

1.1.7.4 Copies to the Owner. Upon Owner's request, the Contractor shall furnish the Owner with copies of Project related correspondence, letters of transmittal, etc.

1.1.8. Defined Terms. Wherever used in the Contract Documents, the terms defined in this Contract will have the meanings indicated that are applicable to both the singular and plural, and to the masculine and feminine thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents may include references to identified Sections and paragraphs, and the titles of other documents or forms.

1.1.8.1 Meaning of Words and Phrases. Unless the context or the Contract Documents taken as a whole indicate to the contrary, words used in the Contract Documents that have usual and common meanings shall be given their usual and common meanings; words having technical or trade meanings shall be given their customary meaning in the subject business, trade, or profession. Materials or work described in words that, so applied, have a well-known technical or trade meaning shall be held to refer to such recognized meaning.

1.1.8.2 Cross-References, Headings, and Citations to the Contract. Cross-references, headings, and citations to the Contract, if any, are for the convenience of the Contractor and the Owner and are not intended to be plenary or exhaustive nor are they to be considered in interpreting the Contract Documents or any part of the Contract Documents.

1.1.8.3 Install, Deliver, Furnish, Supply, Provide and Other Such Words. Install, deliver, furnish, supply, provide, and other such words mean that the Work in question shall be put in place by the Contractor ready for use unless expressly provided to the contrary.

1.1.8.4 Sections Not Plenary. This Section and Section 1.1.9 are not entire, plenary, or exhaustive of all terms used in the Contract and General Requirements that require definition. There may be definitions of other terms under Sections to which the terms are related.

1.1.9 Basic Definitions.

1.1.9.1 *Addenda.* Written or graphic instruments issued by the Design Professional prior to the opening of bids that clarify, correct, or change any of the component parts of the Bidding documents. Standard Addenda are issued by the Owner to add, amend or delete the General Requirements and other terms of the Bidding documents.

1.1.9.2 *Affiliate.* With respect to Contractor, any firm, partnership, corporation or other legal entity that is owned by, under common ownership or control with, or having a common principal or shareholder with, the Contractor, whether such relationship is direct or indirect. In addition, unless the consequences of such relationship for the purposes of this Contract are expressly waived in writing by the Owner after full disclosure by the Contractor, the term "Affiliate" also includes any entity currently affiliated with Contractor as a partner or joint venturer with respect to any commercial venture, whether or not such venture includes the Project. See O.C.G.A. §13-10-23.

1.1.9.3 *Affiliated Contract.* Any agreement concerning the Project between the Contractor and an Affiliate, including all modifications and amendments thereto.

1.1.9.4 *Application for Payment.* The form *(See* Section 7 Forms*)* acceptable to Owner that is to be used by the Contractor during the course of the Work in requesting payment from the Owner and that is to be accompanied by such supporting documentation as is required by the Contract Documents.

1.1.9.5 *Asbestos.* Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

1.1.9.6 *Bid. The* offer of a Bidder submitted on the prescribed form setting forth the Contract Sum for all activities required by the Bidding Documents.

1.1.9.7 *Bid Bond.* A bond, required by law, with a surety in accordance with the Instructions to Bidders, substantially in the form and substance specified in the Bidding Documents, with the Owner as obligee, and intended to secure the execution of the Contract by the Bidder.

1.1.9.8 *Bidding Documents.* The Construction Documents, the Invitation to Bid, the Instructions to Bidders, the Bid Form, and all Addenda (including Standard Addenda), upon which the Bidder submits a Bid.

1.1.9.9 *Bulletin* Written or graphic material issued after the award of the contract that clarifies, corrects, or proposes a change in any of the component parts of the Contract Documents.

1.1.9.10 *Business Day.* A business day is each calendar day other than Saturday, Sunday, and any holiday observed by Owner.

1.1.9.11 *Certificate for Material Completion- Design Professional* The Notice from the Design Professional to the Owner certifying Contractor's achievement of Material Completion and providing for the Owner's authorization for the Using Agency to take possession of the Project.

1.1.9.12 *Change Order.* A document prepared by the Owner and issued on or after the Effective Date of the Contract, signed by the Contractor and the Owner and ordinarily certified by the Design Professional, which may authorize a change or changes, including but not limited to a change to the Contract Sum, the Contract Time, or the Contract Documents

1.1.9.13 *Claim.* A demand or assertion by the Owner or the Contractor seeking an adjustment of the Contract Sum or Contract Time, or both, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and the Contractor arising out of or relating to the Contract. The responsibility to substantiate a Claim shall rest with the party making the Claim. A demand for money or services by a third party, including a Subcontractor or Supplier to the Contractor, is ipso facto not a Claim against the Owner.

1.1.9.14 *Construction Documents.* The architectural and engineering documents setting forth the design for the Project prepared by the Design Professional. Construction Documents include, but are

not limited to, the Specifications, the Drawings, the Supplementary Requirements, the General Requirements, and all Addenda.

1.1.9.15 *Construction Progress Schedule.* A schedule, as more fully defined in Section 2.1.5, prepared by the Contractor, indicating proposed activity sequences and durations, milestone dates for receipt and approval of pertinent information, preparation, submittal, and processing of Shop Drawings and Samples, delivery of materials or equipment requiring long-lead time procurement, and proposed date(s) of Material Completion, Occupancy and Final Completion.

1.1.9.16 *Contract.* The written document that is the evidence of the Contract between the Owner and the Contractor.

1.1.9.17 *Contract Compliance Specialist.* A person, if so designated by the Owner, to record daily events at the Site, including deliveries of equipment and supplies, and the progress of the Work. The Contract Compliance Specialist is not an inspector, and has no authority or power to act as agent for the Owner or to approve or disapprove any action of the Contractor. The Contract Compliance Specialist has no authority to and shall not be requested to sign or initial documents such as delivery receipts, drayage or hauling receipts, or time and materials tickets, or other similar documents evidencing transactions among the Contractor and Subcontractors. (Formally called a Resident Engineer Inspector, "REI.")

1.1.9.18 *Contract Documents.* The Contract Documents include the executed Contract, the Bidding Documents, the Bid and the General Requirements (including Forms and Exhibits) and any Supplementary General Requirements, the Construction Documents and all Change Orders.

1.1.9.19 *Contract Sum.* The amount of money payable by the Owner to the Contractor for completion of the Pre-Commencement Services and the Work in accordance with the Contract Documents.

1.1.9.20 *Contract Time.* The period of time established for completion of the Project by the Contract Documents. Contract Time commences upon the date specified in the Proceed Order and ends upon the Material Completion Date, as it may be amended.

1.1.9.21 *Contractor.* The person or entity responsible for the proper completion of the activities described in the Contract Documents and who executes the Contract (*also referred to as "Construction Professional").*

1.1.9.22 *Cost of the Work.* The sum of all allowable costs necessarily incurred and paid by Contractor in the proper performance of the Work.

1.1.9.23 *Day.* Unless otherwise stated, reference to the terms "day," "days," "month," or "months" mean calendar day, calendar days, calendar month, and calendar months, respectively.

1.1.9.24 *Defective Work.* Work that, for any reason, is not in compliance with the Contract Documents. Defective Work is usually identified in a Notice of Non-Compliant Work.

1.1.9.25 *Design Professional Contract.* The Contract between the Owner and the Design Professional for the design of the Project.

1.1.9.26 *Design Professional.* The architect or engineer or architectural or engineering firm selected by Owner (i) for the design and preparation of Contract Documents governing the construction of a Project, or (ii) for construction contract administration under the Contract Documents, or (iii) for both, all such services and the scope thereof to be set forth in the Design Professional Contract. The Design Professional is not an employee of the Owner but is engaged or retained by it for the purpose of performing design and construction administration services for the project. The term "Design Professional" includes architects, engineers, surveyors, designers, and other consultants retained by the Design Professional.

1.1.9.27 *Drawings.* That part of the Contract Documents prepared or approved by the Design Professional that graphically show the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

1.1.9.28 *Effective Date of the Contract.* The date indicated on the Contract or as otherwise specified therein.

1.1.9.29 *Final Certificate, Design Professional's Certificate of Final Completion.* The Certificate issued by the Design Professional stating that all work has been completed in accordance with the terms of the Contract Documents. See Section 6, Project Completion.

1.1.9.30 *Final Completion.* The full and final completion of all Work in accordance with the Contract Documents.

1.1.9.31 *Final Notice of Non-Compliant Work.* The Final Notice of Non-Compliant Work issued as a result of the Inspection for Material Completion, also known as the Final Punch List. Upon the completion or correction of this Non-Compliant Work ("punch list" work) the Design Professional will issue the Final Certificate.

1.1.9.32 *Hazardous Substances.* See Section 1 Part 6.

1.1.9.33 *Material Completion and "Material Completion Date". See Certificate for Material Completion* and Section 6 Part 1.

1.1.9.34 *Milestone.* A principal event specified in the Contract Documents including the Material Completion Date and other events relating to an intermediate completion date or time. Milestone events will be project-specific, but generally may include, but are not limited to: construction start, site work, completion of clearing and grubbing, grading, foundation preparation, subsurface utilities, utility completion, structural top out, dry-in, rough-in completion, metal stud and drywall completion, equipment installation, systems operational, inspections for Material Completion, Material Completion Date, etc.

1.1.9.35 *Notice.* Written notice. See Section 1.1.5.

1.1.9.36 *Notice of Apparent Successful Bid.* The written notice by the Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, the Owner will sign and deliver the Contract. The Construction Preparation Period begins on the Effective Date of the Contract. (See Section 2, Part 1.)

1.1.9.37 *Notice of Non-Compliant Work.* A Notice of Non-Compliant Work shall be in writing, shall be dated, shall be signed by the Design Professional, and shall be addressed to the Contractor with a copy to the Owner, as set forth in Section 3, Part 4 (Correcting the Work) and Section 6, Part 6 (Correcting the Work after Final Payment).

1.1.9.38 *Owner.* The State of Georgia, by and through a State Agency, identified as such in this Contract with whom Contractor has entered into the Contract and for whom the Work is to be completed.

1.1.9.39 *Owner's Representative.* Owner may from time to time in writing designate one individual as Owner's Representative under this Contract. Owner's Representative so designated in writing shall serve as Owner's Representative unless and until Owner gives notice in writing of the appointment of his successor. All requests for consents and approvals required of Owner in connection with the Project, whether by the Program Manager, Design Professional, Contractor, Owner's Construction Inspector, and or Separate Contractor, shall be submitted to Owner's Representative. The Program Manager, Design Professional, Contractor, Owner's Construction Inspector, and Separate Contractor may rely upon written consents and approvals signed by the Owner's Representative, as the consent and approval of Owner.

1.1.9.40 *Overall Project Schedule or OPS.* The final detailed Construction Progress Schedule created by the CONTRACTOR, that is recommend by the Design Professional and approved by the Owner.

1.1.9.41 *Proceed Order.* The Proceed Order is a written notice from the Owner that includes a specified date upon which the Contractor is authorized to commence physical work on the Site. A Proceed Order is a condition precedent to the execution of any Work on the site by the Contractor. The Proceed Order was formerly referred to as the "Notice to Proceed."

1.1.9.42 *Project.* The total and complete undertaking for the public works facility to be constructed under this Contract.

1.1.9.43 *Project Manual.* A bound manual prepared by the Design Professional. It includes the Invitation to Bid, Instructions to Bidders, the Bid Form, the Specifications, the General Requirements and Supplementary General Requirements.

1.1.9.44 *Reasonable Termination Expenses. See* Section 5, Part 3.

1.1.9.45 *Samples.* Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged. The Contractor shall furnish for approval all samples required by the Contract Documents. The Work shall be in accordance with approved samples.

1.1.9.46 *Separate Contractor.* Any person or entity other than Contractor that enters into an agreement with Owner to perform the construction of all or any portion of the construction on a Project.

1.1.9.47 *Site.* Lands or areas indicated in the Contract Documents as being furnished by the Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by the Owner that are designated for the use of the Contractor. Also referred to as Project Site, Job Site and Premises.

1.1.9.48 *Specifications.* That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto. The term "Specifications" shall also include all written matter in the Project Manual or on the drawings and any Addenda or Change Orders thereto.

1.1.9.49 *Subcontractor.* The generic term subcontractor as employed herein includes only those having a direct contract with the Contractor. The term includes a trade contractor, who furnishes and installs materials according to the plans and specifications of this Project.

1.1.9.50 *Submittals.* Shop Drawings, schedules, data, catalogue cuts, manufacturers' published recommendations, charts, bulletins, brochures, illustrations, circulars, roughing drawings or formulae, etc., that are specifically prepared, distributed, or assembled by or for Contractor or by Subcontractors, manufacturers, or Suppliers and submitted by Contractor to illustrate some portion of the Work or for use in installing the Work. The Contract Documents shall specify when shop drawings or submittals require the seal of a specialty consultant.

1.1.9.51 *Successful Bidder.* The responsible Bidder submitting the lowest responsive Bid.

1.1.9.52 *Supplier.* A manufacturer, fabricator, distributor, supplier, or vendor of goods or equipment in connection with the Work, or any other party having a Contract or Purchase Order with the Contractor or with a Subcontractor to furnish materials or equipment to be incorporated in the Work by the Contractor or a Subcontractor.

1.1.9.53 *Underground Facilities.* All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including without limitation those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

1.1.9.54 *Unit Price Work.* Work to be paid for on the basis of unit prices as defined and described in the Contract Documents. A percentage markup for overhead or profit shall be included in all unit prices.

1.1.9.55 *Using Agency.* The State entity for which the Project is being constructed. The term may include a Tenant or Tenant Agency, such as an institution (e.g., University of Georgia) that is a part of a Using Agency (e.g., the Board of Regents of the University System of Georgia).

1.1.9.56 *Using Agency's Representative.* The Using Agency may designate from time to time a Using Agency's Representative, who shall work with the Design Professional and the Owner's Representative as a liaison with the Using Agency.

1.1.9.57 *Work.* All labor, materials, and services necessary to produce the construction of the Project in accordance with the Contract Documents, including the entire construction or the various separately identifiable parts thereof. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all equipment, fixtures, and supplies into such construction, all as required by the Contract Documents.

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PART 2 – CONTRACTOR'S GENERAL RESPONSIBILITIES AND DUTIES

1.2.1 Contractor's General Responsibilities.

1.2.1.1 Representations of Contractor.

1.2.1.1.1 Independent Contractor. The Contractor represents that it is an independent contractor, competent, knowledgeable, and familiar with the type of work contemplated by this Contract. The Contractor agrees and understands that neither it nor any of its agents or employees may act in the name of the Owner except and unless specifically authorized in writing by the Owner to do so. The Contractor shall furnish construction administration and management services and use the Contractor's best efforts to perform the Project in an expeditious and economical manner consistent with the interests of the Owner.

1.2.1.1.2 Familiarity with Project. Contractor represents that it has: (a) visited and examined the Site(s), (b) taken into account local conditions and observed conditions that affect the Project, the Work, or the cost thereof, (c) investigated the labor situation related to the Project, (d) examined the superintendence of the Project, the Work, the time of completion, and other relevant matters, and (e) has taken these into consideration in submitting his bid.

1.2.1.2 Responsibility to Coordinate. Contractor acknowledges its responsibility to coordinate the Work with that of Separate Contractors to be selected for the installation of other work within the Project, or in the proximity of the Project. Contractor expressly agrees to schedule and, with the assistance of Owner, coordinate the Work with such Separate Contractors and to permit each phase of the Project to be completed on schedule.

1.2.1.3 Project Delivery. Contractor shall construct the Project in accordance with the Contract Documents, and Contractor shall deliver the Project completed in accordance with the Contract Documents, free from defects, and within the Contract Time.

1.2.1.4 Contractor's Warranty as to Performance. The Contractor warrants that he is familiar with the codes applicable to the Work and that he has the skill, knowledge, competence, organization, and plan to execute the Work promptly and efficiently in compliance with the requirements of the Contract Documents. The Contractor has the obligation to keep a competent superintendent on the Work during its progress, to employ only skilled workers, and to enforce strict discipline and good order among his employees. The Contractor is responsible for seeing that the Work is installed in accordance with the Contract Documents. Failure or omission on the part of the Owner, representatives of the Owner, agents of the Owner, the Contract Compliance Specialist, engineers employed by the Design Professional, representatives of the Design Professional, or the Design Professional either to discover or to bring to the attention of the Contractor any deviation from, omission from, or noncompliance with the Contract Documents shall not be used by the Contractor or its surety as a defense for failure on his part to install the Work in accordance with the Contract Documents or for any other neglect to fulfill requirements of the Contract; neither shall the presence of any one, or all, or any of the foregoing at the Site or the fact that any one, or all, or any of the foregoing may have examined the Work or any part of the Work be used as a defense by the Contractor against a claim for failure on his part to install the Work in accordance with the Contact Documents or for any neglect to fulfill requirements of the Contract. No requirement of this Contract may be altered or waived except by Change Order.

1.2.2 Contractor's General Duties.

1.2.2.1 Construction Stage and Construction Services. The Contractor shall provide and pay for all labor, materials, equipment, transportation, construction, resources, work, and services necessary or incidental to completing the Work for each phase of the Project in a proper and timely manner in accordance with the Contract Documents and applicable laws.

1.2.2.2 Supervision and Direction. Contractor shall supervise and direct the Work using diligent skill and attention. Contractor shall be responsible for and shall coordinate all construction means, methods, techniques, sequences, and procedures. (*See* Section 3.1.1 *et seq.*)

1.2.2.3 Enforce Discipline. Contractor shall at all times enforce strict discipline and good order among its employees, Subcontractors, and others performing the Work, and shall not employ or permit the employment of unfit persons or persons not skilled in the task assigned to them.

1.2.2.4 Security Clearances. Where work is required within a specially secured controlled access environment, work shall be performed by personnel who have passed a security screening.

1.2.2.5 Maintain Records. Contractor shall keep Owner informed of the progress of the Work. Contractor shall maintain records of the cost for the Work pursuant to and in compliance with GASB 34 accounting requirements and such other methods as Owner may require, including complete backup documentation for all pay applications.

1.2.2.6 Answer Questions. Contractor, with reasonable promptness and in accordance with time limits set by Owner, shall answer Owner's questions and provide Owner with requested Project information.

1.2.2.7 Acts and Omissions. Employees of or Subcontractors to the Contractor shall perform the Work required by this Contract. The Contractor is responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons.

1.2.2.8 Contractor. Contractor shall, in coordination with the Design Professional, accomplish the construction of the Project, including all required submittals, and such Change Orders as may be issued.

1.2.2.9 Meetings with the Owner. Contractor shall schedule and conduct meetings with the Owner, Design Professional, Separate Contractors, and appropriate Subcontractors, not less than biweekly, for the purpose of discussing the status and progress of the Work. Additional such meetings shall be held as often as Owner determines.

1.2.2.10 Schedule and Coordination Meetings. Contractor shall schedule and conduct meetings as necessary with Subcontractors, Suppliers, and other appropriate Project Team Members to coordinate and schedule the Work.

1.2.3 Audit. At the request of the Owner, the Contractor shall allow the Owner the opportunity to select an auditor to examine and inspect the Project and the Contractor's books, records, and any and all accounts and similar data related to the Project. The Owner shall bear the cost of such audit. The auditor may sign a confidentiality agreement before conducting any such audit. Notwithstanding such agreement, Contractor understands and agrees that all project records are subject to the Georgia Open Records Act.

1.2.4 Employment of Georgia Citizens and Use of Georgia Products and Georgia Forest Products. Given that the Work provided for in this Contract is to be performed in Georgia, it is the wish of the Owner that materials and equipment manufactured or produced in Georgia shall be used in the Work and that Georgia citizens shall be employed in the Work at wages consistent with those being paid in the general area in which the Work is to be performed. This desire on the part of the Owner is not intended to restrict or limit competitive bidding nor to increase the cost of the Work; nor shall the fulfillment of this desire be asserted by the Contractor as an excuse for any noncompliance or omission to fulfill any obligation under the Contract. O.C.G.A. §§50-5-60 to 63 are further incorporated into the General Requirements of the Contract as expressed below:

> (a) No contract for the construction of, addition to, or repair of any facility, the cost of which is borne by the State, or any department, agency, commission, authority, or political subdivision thereof shall be let, unless said contract contains a stipulation therein providing that the Contractor, Construction Manager or Subcontractor shall use exclusively Georgia forest products in construction thereof, when forest products are to be used in such construction, addition or repair, and if Georgia forest products are available.
> (b) These provisions shall not apply when in conflict with Federal law, rules, and regulations concerning interstate commerce or construction.

PART 3 – OWNER'S GENERAL RESPONSIBILITIES AND RIGHTS

1.3.1 Owner's Representative.

1.3.1.1 Written Designation. The Owner shall designate, in writing, a representative authorized to act on the Owner's behalf with respect to the Project. The Owner hereby designates the party identified in the Contract as its initial authorized representative and reserves the right to designate additional or replacement representatives by written notice to the Contractor.

1.3.1.2 Accessibility. The Owner's Representative shall be readily accessible (either on site or by computer, phone, fax or otherwise), shall be well acquainted with the Project, and shall have authority promptly to render decisions and to furnish information required of, or to be provided by, the Owner hereunder.

1.3.1.3 Independent Review and Inspection. The Owner may undertake independent inspection of the installation of the Work. Such independent inspector shall operate on behalf of the Owner and shall act to protect the best interests of the Owner.

1.3.2 Design Professional.

1.3.2.1 Design Professional to Design Work. The Design Professional Contract requires the Design Professional to design and to prepare the Contract Documents, a copy of which shall be furnished to the Contractor upon request. The Design Professional Contract requires the Design Professional to designate a readily accessible representative (either on Site or by computer, phone or fax or otherwise) who shall have authority promptly to render decisions and to furnish information required of the Design Professional.

1.3.2.2 Copies of Contract Documents to Contractor. The Design Professional Contract requires that the Contractor be furnished, free of charge, up to twenty-five sets of completed Contract Documents in hard copy, one full set of reproducible drawings and electronic background floor and reflected ceiling plan drawings and, if requested, one complete copy in read-only electronic format. The Contractor may obtain such additional sets of Contract Documents as the Contractor deems necessary and shall pay the cost of reproduction of such additional sets to the Design Professional.

1.3.2.3 Contract Administration. The Design Professional shall provide periodic review of the Work to assess compliance with the Contract Documents. The Design Professional shall not review any Work in respect to safety. The Design Professional is not the agent of the Owner, but is engaged as a consultant to the Owner to assist the Owner in determining if the conditions of the contract have been met. He is the agent of the Owner only when in special instances he is authorized in writing by the Owner so to act, and in such instances he shall, upon request, show the Contractor written authority. He has authority to stop the Work whenever such stoppage may be necessary to enforce the proper execution of the Contract.

1.3.2.4 Impartial Decisions. The Design Professional is the interpreter of the conditions of the Construction Contract and the judge of its performance, in the first instance. The Design Professional shall side neither with the Owner nor with the Contractor, but shall use its powers to enforce performance by both.

1.3.2.5 Design Professional Decisions. Design Professional's decisions must be in writing and signed by the Design Professional of Record.

1.3.2.5.1 Promptness. The Design Professional shall make decisions within fourteen calendar days after proper presentation of evidence on (1) any issue, claim, or dispute of the Owner or Contractor, or (2) a demand of the Owner or Contractor for a decision on any matter relating to the execution or progress of the Work.

1.3.2.5.2 Additional Time. If because of events beyond the Design Professional's reasonable control, it is not able to meet the specified time period, then it should be entitled to ask the Owner for additional time, which request shall not be unreasonably denied.

1.3.2.5.3 Protests of Design Professional's Decisions. All decisions of the Design Professional on any claim, dispute, or demand shall be final and binding on the Contractor in the absence of written notice of protest from the Contractor received by the Owner within fourteen calendar days of the date of the decision of the Design Professional is received by the contractor. See Section 5 Part 2.

1.3.2.6 Aesthetics. All decisions of the Design Professional on matters of aesthetics are final, conclusive, and binding on all parties if consistent with the requirements of the Contract Documents.

1.3.2.7 Succession. In case of the termination of the employment of the Design Professional, the Owner shall appoint a capable and reputable Design Professional against whom the Contractor makes no reasonable objection and whose status under the Contract shall be that of the former Design Professional.

1.3.3 Permits, Licenses, and Inspections. The Owner shall cooperate with the Contractor in obtaining building and other permits, licenses, and inspections. *See also* Subparagraph 2.1.2.2.3 and Section 2.2.5.

1.3.4 Testing. The Owner shall provide and pay for initial and subsequent independent construction testing as required by the Contract Documents. Laboratories for testing services shall be selected by, engaged by, and responsible to the Design Professional. In the case of tests (a) prescribed in the Contract Documents or any part thereof, or (b) requested by the Design Professional, the Contractor must give notice to the selected testing agency stating the date and the hour when he will be ready for the test to be made. In the event the test fails or the Contractor is not ready for the test, the expense of the services of the testing laboratory shall be deducted from the Contract Sum, upon notice to the Contractor by the Owner accompanied by a copy of the invoice for the testing services for the test that failed or for which the Contractor was not ready. The notice and readiness provisions of this Section do not apply to verification of design mix on concrete.

1.3.5 No Partial Occupancy. There shall be no partial occupancy by the Using Agency of the Project prior to the achievement of Material Completion. This provision may be modified in the Supplementary General Requirements only for phased construction projects with stand-alone components, or may be modified by Change Order.

1.3.6 Disqualification of Potential "Pre-Qualified" Subcontractors. The Owner may disqualify for just cause any potential subcontractors. Owner shall pay any difference in the cost of the Work resulting from such disqualification pursuant to the provisions of Section 5 Part 2.

1.3.7 Owner's Right to Perform Work. The Owner reserves the right to perform construction or operations related to the Project with Separate Contractors on the Site. If the Contractor claims that delay or additional cost is because of such action by the Owner, the Contractor shall assert such claims as provided in Section 5, Part 2 of the General Requirements.

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PART 4 – PROTECTION OF PERSONS AND PROPERTY

1.4.1 Reasonable Precautions. The Contractor shall take reasonable precautions for the safety of, and shall provide reasonable protection to prevent damage, injury or loss to: (a) employees performing the Work and other persons, including without limitation the General Public, who may be affected thereby; (b) the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site, under care, custody, or control of the Contractor or the Contractor's Subcontractors; or (c) other property at or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation, replacement or other rearrangement in the course of construction.

1.4.2 Duty to Protect Property. The Contractor shall continuously maintain adequate protection of the Work from damage and shall protect all other property on the Site from damage, injury, or loss regardless of who may be the owner of said property. He shall make good any such damage, injury, or loss.

1.4.3 Safety Precautions. The Contractor shall comply with the rules and regulations of OSHA and the Department of Labor (O.C.G.A. Section §34-2-6), and, where not inconsistent with the foregoing, the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc., for safety and prevention of accidents, and shall maintain an accurate record of all cases of death, occupational disease, and injury requiring medical attention or causing loss of time from work arising out of and in the course of employment on work under the Contract. The Contractor alone shall be responsible for the safety, efficiency, and adequacy of his plant, appliances, and methods, and for any damage that may result from their improper construction, maintenance, or operations. He shall erect and properly maintain at all times, as required by the conditions and progress of the Work, proper safeguards for the protection of workers and the public and shall post danger warnings against any hazards created by the construction operations. The Contractor shall designate a responsible member of his organization, normally the superintendent, whose duty shall be the prevention of accidents.

1.4.4 Emergencies. In an emergency affecting the safety of persons or property or the Work or of adjoining property, the Contractor shall take reasonable precautions to prevent imminent damage, injury, or loss.

1.4.5 Fire Protection. Contractor shall take adequate and reasonable precautions to protect the Work against damage by fire and smoke. For example, without limitation, Contractor shall do the following:

(a) Provide fire extinguishers or fire hoses in readily accessible locations;
(b) Periodically inspect fire extinguishers, remove discharged extinguishers immediately, and replace with new or recharged extinguishers;
(c) Keep fire extinguishers or fire hoses within five (5) feet of any welding or open flame operations;
(d) Remove oil-soaked and paint-soaked materials, including paper and rags, from the Site daily, and more frequently as necessary, to eliminate danger of fire.
(e) Prohibit workers from smoking during operations involving combustible adhesives, solvents, mastics, or other fire hazard materials.

1.4.6 Remedy Damages. The Contractor shall promptly remedy damages and loss to property at the Site caused by the Contractor, by any Subcontractor, by anyone directly or indirectly employed by the Contractor or any such Subcontractor, or by anyone for whose acts the Contractor or any such Subcontractor may be liable. Should the Contractor cause damage to any Separate Contractor's work, the Contractor agrees, upon due notice, to settle with the Separate Contractor.

1.4.7 Written Programs. Contractor shall have in place the plans proscribed in Section 2 Part 1 as well as appoint a designated (qualified) coordinator as the point of contact during the Project. Such plans shall be on the Site and the superintendent and the project management team shall be familiar with and utilize such programs.

PART 5 – BONDS, INDEMNITY, AND INSURANCE

1.5.1 Bonds

1.5.1.1 Performance Bond and Payment Bond. The Contractor shall furnish both a performance bond and a payment bond in the exact form set forth in Section 7, (Forms) of these General Requirements.

1.5.1.2 Required Qualifications for Surety. The Contract provides that the surety and insurance companies must be acceptable to the Owner. Only those sureties listed in the Department of Treasury's Listing of Approved Sureties (Department Circular 570) are acceptable to the Owner. All bonds at the time of issuance must be issued by a company authorized by the Insurance Commissioner to transact the business of suretyship in the State of Georgia, and shall have a Best Policyholders Rating of "A-" or better and with a financial size rating of Class V or larger.

1.5.1.3 Penal Amount of Bonds, State Law. The Contractor acknowledges and agrees that, pursuant to O.C.G.A. §§13-10-2, 13-10-20, 13-10-40 and 13-10-60, the performance bond and the payment bond must be in a penal amount equal to at least 100% of the Contract Sum. Accordingly, the Contractor warrants and agrees that, for any Change Order increasing the Contract Sum by five percent or more or when the total cost of the work has increased by five percent or more, it shall obtain a written amendment to the payment bond and the performance bond increasing the penal amounts of both bonds to 100% of the Contract Sum, effective as of the date of the Change Order. The premium increase, if any, may be properly included in the cost of the Change Order. The Design Professional shall approve no payment for the work provided by the Change Order until the Contractor has provided the written amendment to the Owner.

1.5.2 Liability and Indemnification.

1.5.2.1 General Liability. The Contractor shall be responsible to the Owner from the time of the signing of the agreement or the beginning of the first work, whichever shall be earlier, for all injury or damage of any kind resulting from any negligent act or omission or breach, failure or other default regarding the Work by the Contractor, or any of its Subcontractors, its agents, employees or others working at the direction of the Contractor or on its behalf, regardless of who may be the owner of the property.

1.5.2.2 Indemnification Agreement. Contractor hereby agrees to indemnify and hold harmless the Owner, the State of Georgia and its departments, agencies and instrumentalities and all of their respective officers, members, employees and directors (hereinafter collectively referred to as the "Indemnitees") from and against any and all claims, demands, liabilities, losses, costs or expenses, including attorneys' fees, due to liability to a third party or parties, for any loss due to bodily injury (including death), personal injury, and property damage arising out of or resulting from the performance of this Contract or any act or omission on the part of the Contractor, its agents, employees or others working at the direction of Contractor or on its behalf., or due to any breach of this Contract by the Contractor, or due to the application or violation of any pertinent Federal, State or local law, rule or regulation. This indemnification extends to the successors and assigns of the Contractor. This indemnification obligation survives the termination of the Contract and the dissolution or, to the extent allowed by law, the bankruptcy of the Contractor. If and to the extent such damage or loss (including costs and expenses) as covered by this indemnification is paid by the State Tort Claims Trust Fund, the State Authority Liability Trust Fund, the State Employee Broad Form Liability Fund, the State Insurance and Hazard Reserve Fund, and other self-insured funds (all such funds hereinafter collectively referred to as the "Funds") established and maintained by the State of Georgia Department of Administrative Services Risk Management Division (hereinafter "DOAS") the Contractor agrees to reimburse the Funds for such monies paid out by the Funds.

1.5.2.2.1 This indemnification does not extend beyond the scope of this Contract and the work undertaken thereunder. Nor does this indemnification extend to claims for loses or injuries or damages incurred directly by the Indemnitees due to breach, negligence or default by the Indemnitor under the terms and conditions of this Contract.

1.5.2.2.2 This indemnification does not extend to claims for loses or injuries or damages incurred by the Indemnitees due to any negligent act, error, or omission of a design

professional in the performance of professional services that fails to meet the applicable professional standard of care, skill and ability as employed by others in their profession.

1.5.2.3. DOAS Role. DOAS Risk Management Division serves as Owner's insurer. Owner will notify affected insurers of claims made against the State that fall within this indemnity when such notice is received by Owner. In the event of litigation, the Attorney General will endeavor to keep the Contractor and its general liability insurer as named on the insurance certificate informed regarding the claims and settlement.

1.5.2.4 Suits or Claims for Infringement. The Contractor shall indemnify and hold the Owner harmless from any suits or claims of infringement of any patent rights or copyrights arising out of any patented or copyrighted materials, methods, or systems used by the Contractor.

1.5.3 Insurance Requirements.

1.5.3.1 Insurance Certificates. The Contractor shall, in accordance with 2.1.2.2.2, procure the insurance coverages identified below at the Contractor's expense (e.g. within the bid price and Contract Sum) and shall furnish the Owner an insurance certificate listing the Owner as the certificate holder and as an additional insured. The insurance certificate must provide the following:

(a) Name and address of authorized agent
(b) Name and address of insured
(c) Name of insurance company(ies)
(d) Description of policies
(e) Policy Number(s)
(f) Policy Period(s)
(g) Limits of liability
(h) Name and address of Owner as certificate holder
(i) Project Name and Number
(j) Signature of authorized agent
(k) Telephone number of authorized agent
(l) Mandatory thirty day notice of cancellation or non-renewal (except ten days for non payment).

1.5.3.2 Insurer Qualifications, Insurance Requirements. Each of the insurance coverages required below (i) shall be issued by a company licensed by the Insurance Commissioner to transact the business of insurance in the State of Georgia for the applicable line of insurance, and (ii) shall be an insurer (or, for qualified self-insureds or group self insureds, a specific excess insurer providing statutory limits) with a Best Policyholders Rating of "A-" or better and with a financial size rating of Class V or larger. Each such policy shall contain the following provisions:

1.5.3.2.1 The insurance company agrees that the policy shall not be canceled, changed, allowed to lapse or allowed to expire until thirty days after the Owner has received written notice thereof, as evidenced by return receipt of certified mail or statutory mail, or until such time as other insurance coverage providing protection equal to protection called for in this Contract shall have been received, accepted and acknowledged by the Owner. Such notice shall be valid only as to the Project as shall have been designated by Project Number and Name in said notice.

1.5.3.2.2 The policy shall not be subject to invalidation as to any insured by reason of any act or omission of another insured or any of its officers, employees, agents or other representatives ("Separation of Insureds").

1.5.3.2.3 Each Insurer is hereby notified that the statutory requirement that the Attorney General of Georgia shall represent and defend the Indemnities remains in full force and effect and is not waived by issuance of any policy of insurance. In the event of litigation, any settlement on behalf of the indemnities must be expressly approved by the Attorney General. The Contractor and its insurance carrier may retain, but are not obligated to retain, counsel to assist with the defense of the Indemnities, in which case there will be mutual cooperation between the Attorney General and such counsel. See O.C.G.A. § 45-15-12.

1.5.3.2.4 All deductibles shall be paid for by the Contractor.

1.5.3.2.5 The maximum deductible, except for Worker's Compensation qualified self-insurers or group self-insurers, in any policy shall not exceed $100,000.00.

1.5.3.3 Required Insurance Coverages. The Contractor also agrees to purchase insurance and have the authorized agent state on the insurance certificate that the Contractor has purchased the following types of insurance coverages, consistent with the policies and requirements of O.C.G.A. §50-21-37. The minimum required coverages and liability limits are as follows:

1.5.3.3.1 Workers' Compensation Insurance. The Contractor agrees to provide at a minimum Workers' Compensation coverage in accordance with the statutory limits as established by the General Assembly of the State of Georgia. A group insurer must submit a certificate of authority from the Insurance Commissioner approving the group insurance plan. A self-insurer must submit a certificate from the Georgia Board of Workers' Compensation stating the Contractor qualifies to pay its own workers' compensation claims. The Contractor shall require all Subcontractors performing work under this Contract to obtain an insurance certificate showing proof of Workers' Compensation Coverage and shall submit a certificate on the letterhead of the Contractor in the following language:

This is to certify that all Subcontractors performing work on this Project are covered by their own workers' compensation insurance or are covered by the Contractor's workers' compensation insurance.

1.5.3.3.2 Employers' Liability Insurance. The Contractor shall also maintain Employer's Liability Insurance Coverage with limits of at least:

(i) Bodily Injury by Accident - $1,000,000 each accident; and
(ii) Bodily Injury by Disease - $1,000,000 each employee.

The Contractor shall require all Subcontractors performing work under this Contract to obtain an insurance certificate showing proof of Employers Liability Insurance Coverage and shall submit a certificate on the letterhead of the Contractor in the following language:

This is to certify that all Subcontractors performing work on this Project are covered by their own Employers Liability Insurance Coverage or are covered by the Contractor's Employers Liability Insurance Coverage.

1.5.3.3.3 Commercial General Liability Insurance. The Contractor shall provide Commercial General Liability Insurance (2004 ISO Occurrence Form or equivalent) that shall include, but need not be limited to, coverage for bodily injury and property damage arising from premises and operations liability, products and completed operations liability, blasting and explosion, collapse of structures, underground damage, personal injury liability and contractual liability. The CGL policy must include separate aggregate limits per Project and shall provide at a minimum the following limits:

	Coverage	***Limit***
1.	Premises and Operations	$ 1,000,000.00 per Occurrence
2.	Products and Completed Operations	$ 1,000,000.00 per Occurrence
3.	Personal Injury	$ 1,000,000.00 per Occurrence
4.	Contractual	$ 1,000,000.00 per Occurrence
5.	General Aggregate	$ 2,000,000.00 per Project

Additional Requirements for Commercial General Liability Insurance are shown below at Paragraph 1.5.3.3.6.

1.5.3.3.4 Commercial Business Automobile Liability Insurance. The Contractor shall provide Commercial Business Automobile Liability Insurance that shall include coverage for bodily injury and property damage arising from the operation of any owned, non-owned, or hired automobile. The Commercial Business Automobile Liability Insurance Policy shall provide not less than $1,000,000 Combined Single Limits for each occurrence. Additional

Requirements for Commercial Business Automobile Liability Insurance are shown below at Paragraph 1.5.3.3.6.

1.5.3.3.5 Commercial Umbrella Liability Insurance. The Contractor shall provide a Commercial Umbrella Liability Insurance to provide excess coverage above the Commercial General Liability, Commercial Business Automobile Liability and the Workers' Compensation and Employers' Liability to satisfy the minimum limits set forth herein. The umbrella coverage shall follow form with the Umbrella limits required as follows:

For Contract Amounts Less Than $5,000,000.00:	*For Contract Amounts Equal to or Greater than $5,000,000:*
$ 2,000,000 per Occurrence $ 4,000,000 Aggregate	$2,000,000 per Occurrence $10,000,000 Aggregate

Additional Requirements for Commercial Umbrella Liability Insurance are shown below at Paragraph 1.5.3.3.6.

1.5.3.3.6 Additional Requirements for Commercial Policies in Paragraphs 1.5.3.3.3 through 1.5.3.3.5

(a) The Contractor shall cause its insurer to issue an Additional Insured Endorsement naming the officers, members and employees of the Owner and the Using Agency as additional insureds.

(b) The policy must be on an "occurrence" basis.

1.5.3.3.7 Builders Risk Insurance. Contractor shall provide a Builder's Risk Policy to be made payable to the Owner and Contractor, as their interests may appear. The policy amount should be equal to 100% of the Contract Sum, written on a Builder's Risk "All Risk", or its equivalent. The policy shall be endorsed as follows:

The following may occur without diminishing, changing, altering or otherwise affecting the coverage and protection afforded the insured under this policy:

(i) Furniture and equipment may be delivered to the insured premises and installed in place ready for use; and
(ii) Partial or complete occupancy by Owner; and
(iii) Performance of work in connection with construction operations insured by the Owner, by agents or lessees or other Contractors of the Owner or Using Agency

In the event that the Contract is for renovation, addition or modification of an existing structure and Builders Risk Insurance is not available, the Owner will accept an Installation Floater Insurance Policy with the above endorsements in lieu of the Builders' Risk Insurance Policy. Such floater must insure loss to materials and equipment prior to acceptance by Owner and must be on an ALL RISK BASIS with the policy written on a specific job site.

1.5.3.3.8 Disposition of Insurance Documents. One original certificate of insurance with all endorsements attached must be deposited with Owner for each insurance policy required.

1.5.3.4 Termination of Obligation to Insure. Unless otherwise expressly provided to the contrary, the obligation to insure as provided herein shall not terminate until the Design Professional shall have executed the Certificate of Material Completion.

1.5.3.5 Failure of Insurers. The Contractor is responsible for any delay resulting from the failure of his insurance carriers to furnish proof of proper coverage in the prescribed form.

PART 6 – HAZARDOUS CONDITIONS AND MATERIALS

1.6.1 Hazardous Materials.

1.6.1.1 Definition.

1.6.1.1.1 The term "Hazardous Materials shall mean any material or substance within the meaning and definition for "Hazardous Substance" and/or "Hazardous Waste" as those terms are employed and set forth in the Georgia Hazardous Site Response Act and the Comprehensive Environmental Response Compensation and Liability Act as amended, 42 USC § 6901 et seq., and regulations promulgated thereunder (collectively "CERCLA") and any corresponding state or local law or regulation, and shall also include: (a) any Pollutant or Contaminant as those terms are defined in CERCLA; (b) any Solid Waste or Hazardous Constituent as those terms are defined by, or are otherwise identified by, the Resource Conservation and Recovery Act as amended, 42 USC § 6901 et seq., and regulations promulgated thereunder (collectively "RCRA") and any corresponding state or local law or regulation; (c) crude oil, petroleum and fractions of distillates thereof and petroleum releases ; (d) any other material, substance or chemical defined, characterized or regulated as toxic or hazardous under any applicable law, regulation, ordinance, directive or ruling, including, but not limited to, Asbestos or polychlorinated biphenyl (PCB),and, (e) any infectious or medical waste or environmental contamination as defined by any applicable federal or state laws or regulations.

1.6.1.1.2 The term "Hazardous" Materials does not include those materials that are expressly and specifically required to be installed under the Contract Documents.

1.6.1.1.3 The term "Hazardous" Materials does not include products or materials that are commonly used in construction or industrial practice so long as they are used in accordance with the manufacturer's instructions or Material Safety Data Sheets issued for the product or materials. (*See* Section 1.6.3 below.)

1.6.1.2 Obligation to Notify Owner of Existing Hazardous Materials. In addition to applicable regulatory and emergency response agencies as applicable, the Contractor shall immediately notify the Owner and the Design Professional, both orally and in writing, of the presence and location of any physical evidence of, or information regarding the presence of Hazardous Materials at the Site of which it becomes aware. If the Contractor encounters Hazardous Materials on the Site the Contractor shall (i) immediately stop performance of Work or that portion of the Work affected by or affecting such Hazardous Materials; (ii) secure the contaminated area against intrusion; (iii) not disturb or remove the Hazardous Materials; (iv) not proceed, or allow any Subcontractor or Supplier to proceed, with any Work or other activities in the area affected by such Hazardous Materials until such materials have been properly remediated and until directed in writing to do so by the Owner; and, (v) take any other steps necessary to protect life and health and the surrounding environment. The Contractor shall be entitled to adjustment of the Contract Time and the Contract Sum pursuant to Section 5, Part 2 of these General Requirements in order to compensate for the impact of any required demolition, re-work, shutdown, delay, protection of work, disruption, and start-up resulting from the encountering of such Hazardous Materials on the Site for which the Contractor is not responsible.

1.6.1.3 Prohibition Against Selecting and Installing Products Containing Hazardous Materials. The Contractor shall not select, install or otherwise incorporate any products or materials containing Hazardous Materials within the boundaries of the Site. Should the Contractor or any Subcontractors have knowledge that, or believe that, an item, component, material, substance, or accessory within a product or assembly selected by the Design Professional, Contractor or any Subcontractor may contain Hazardous Materials it is the Contractor's responsibility to secure a written certification from the manufacturer of any suspected material which identifies the specific Hazardous Material(s) contained, together with the Material Safety Data Sheets (MSDS) for such materials which shall be submitted to the Owner and Design Professional.

1.6.1.4 Fill, Backfill and Landscaping. No soil found on Site, or transported to the Site from remote locations, which contains debris or waste or Hazardous Materials shall be used for fill, backfill or landscaping topsoil.

1.6.2 Responsibility and Warranty of Subcontractors, and Suppliers. Products that are specified by reference standards or in descriptive manner without a manufacturer's name, model number or trade name, to be selected by the Contractor, shall not contain Hazardous Materials in any form, except as and to the extent permitted in 1.6.1, above, and 1.6.3, below. The Contractor shall require that each of its Subcontractors and Suppliers warrant to the Owner and Design Professional that all materials, products and assemblies, other than those which specifically and expressly required by the Contract Documents, incorporated, or submitted for incorporation into this Project, are free of Hazardous Materials. This warranty shall also include all materials, components, and accessories not specifically enumerated or detailed in the Contract Documents but which are required by performance specifications or recommended by manufacturers for complete installation of materials, products and assemblies.

1.6.3 Hazardous Materials and Substances Used On the Job Site. Products containing Hazardous Materials may be employed in the performance of work by the Contractor and its Subcontractors, as allowed by subparagraph 1.6.1.1.2 and 1.6.1.1.3 above, as a means and methods application or as part of its performance of the Work, such as chemicals used on the Site, but only provided that: (i) such products are used In accordance with the manufacturer's instructions and Material Safety Data Sheets; (ii) such products are rendered harmless upon completion of the affected Work; (iii) reasonable precautions can be and are taken to prevent foreseeable bodily injury or death to persons involved in the Work or in its proximity, including the ultimate users of the completed Work; (iv) the Contractor shall make available to the Owner and the Design Professional copies of Material Safety Data Sheets (MSDS) for any such products used on the Site, and (v), the Contractor shall immediately notify Owner, Design Professional and appropriate regulatory agencies if there is a spill or release or misuse of any such product used on the Site that exceeds State or Federal reportable limits.

1.6.4 Hazardous Conditions. The Contractor and Owner acknowledge that previously unknown hazardous conditions may be uncovered at any job site, and in particular where existing structures are being demolished and/or remodeled to accommodate new construction or to reutilize existing facilities. Should a hazardous condition not involving Hazardous Materials as set forth above be encountered on the Site, and should reasonable safety precautions be deemed by the Contractor in good faith to be inadequate to prevent foreseeable personal injury to persons encountering the hazardous condition, the Contractor shall, upon recognizing the hazardous condition, stop work in the affected area and immediately report the hazardous condition to the Design Professional and Owner in writing. The Owner shall undertake, or shall contract (by Change Order) with the Contractor or contract with a Separate Contractor, to resolve the condition. So long as the hazardous condition did not result from activities or substances brought on the Site by the Contractor, the Contractor is entitled to adjustments in the Contract Time and the Contract Sum as set forth in Section 1.6.1.2 above.

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PART 7 – MISCELLANEOUS PROVISIONS

1.7.1 Legal Compliance.

1.7.1.1 General. This Contract shall be governed by the law of Georgia. The Contractor shall comply with all laws, rules, regulations, ordinances, and orders of any government agency having jurisdiction in the performance of the Work and shall ensure the compliance of its Subcontractors.

1.7.1.2 Specific Laws. Without limiting the generality of the foregoing Paragraph, the following laws are specifically referenced:

1.7.1.2.1 The Drug-Free Workplace Act, O.C.G.A. § 50-24-1, *et seq.*

1.7.1.2.2 Preference for Georgia Supplies, materials, equipment, and agricultural products, O.C.G.A. §§50-5-60 through 61.

1.7.1.2.3 Preference for Georgia forest products, O.C.G.A. § 50-5-63.

1.7.1.2.4 Preference for local sellers of Georgia products, O.C.G.A. § 50-5-62.

1.7.1.2.5 Standards and Requirements for Construction, Alterations, etc., O.C.G.A. § 8-2-1 *et seq.*

1.7.1.2.6 Control of Soil Erosion and Sedimentation, O.C.G.A. § 12-7.1, *et seq.*

1.7.1.2.7 Regulation of Fire and other Hazards, O.C.G.A. § 25-2-1 *et seq.*

1.7.1.2.8 Regulation of Blasting Operations, O.C.G.A. § 25-2-1 *et seq.* and 25-9-1 *et seq.*

1.7.1.2.9 Providing safe workplace, O.C.G.A. §s 34-2-10 and 34-7-20

1.7.1.2.10 Georgia Facility Protection Act, O.C.G.A. § 25-9-1 *et seq.* (*Underground Gas Pipe Law)*

1.7.1.2.11 High Voltage Safety Act, O.C.G.A. § 46-3-30 *et seq.*

1.7.1.2.12 Access and Use by Physically Handicapped Persons, O.C.G.A. § 30-3-1 *et seq.*

1.7.1.2.13 Small and Minority Business Enterprises, O.C.G.A. §s 50-5-120 *et seq.* and 50-5-130 *et seq.*

1.7.1.2.14 Trading with the State or State Officials, O.C.G.A. §s 45-10-20 to 45-10-71.

1.7.1.2.15 Title VII of the Civil Rights Act, 42 U.S.C. § 2000a through 2000h-6

1.7.1.2.16 Age Discrimination in Employment Act, 29 U.S.C. § 621 *et seq.*; 42 U.S.C. § 6101 *et seq.*

1.7.1.2.17 Americans with Disabilities Act, 42 U.S.C. § 12101 *et seq.*

1.7.1.2.18 Federal Occupational Safety and Health Act, 29 U. S. C. § 651 *et seq.*

1.7.1.2.19 Federal Emergency Planning and Community Right-to-Know Act, 42 U. S. C. § 11001 *et seq.*

1.7.1.2.20 Georgia Open Records Act, O.C.G.A §50-18-70 *et seq.*

1.7.1.2.21 Georgia Blasting Standards Act, O.C.G.A. § 25-8-1 *et seq.* and Blasting, Excavating Nearby Underground Gas Pipes and Utilities, 25-9-1 *et. seq.*

1.7.1.2.22 Scaffolding and Staging Statute, O.C.G.A. §34-1-1 *et seq.*

1.7.1.2.23 Department of Labor Rules and Regulations, O.C.G.A. *§* 34-2-6 *et seq.*

1.7.1.2.24 Hazardous Chemical Protection and Right to Know Act, O.C.G.A. *§* 45-22-2 *et seq.*,

1.7.1.2.25 Retainage on Public Works Contracts, 0.C.G.A. §13-10-80 *et seq.*

1.7.1.2.26 Compliance with "federal work authorization programs" and federal Immigration Reform and Control Act of 1986 by Georgia Public Employers, contractors and subcontractors, 0.C.G.A. §13-10-90 *et seq.*

1.7.1.3 Building Codes. The following Building Codes, as approved by the Georgia Department of Community Affairs, shall be used. (*See* O.C.G.A. §8-2-20.) The Design Professional will designate any additional codes or special modifications in the Supplementary General Requirements.

- International Building Code with Georgia Amendments
- International Fire Code, with Georgia Amendments
- International Plumbing Code, with Georgia Amendments
- International Mechanical Code, with Georgia Amendments
- International Fuel Gas Code, with Georgia Amendments
- National Electrical Code, with Georgia Amendments
- International Energy Conservation Code, with Georgia Supplements and Amendments

1.7.1.4 Fire, Life Safety, and Accessibility Codes. The following codes, in the versions approved by the Georgia State Fire Marshal/Fire Safety Commissioner and Department of Human Resources, shall be used. The Design Professional will designate any additional codes or special modifications in the Supplementary General Requirements.

- Georgia State Life Safety Code (NFPA 101)
- State Accessibility Codes (*See* O.C.G.A. §30-3-3)
- Rules and Regulations of the Georgia Safety Fire Commissioner (*See* O.C.G.A. §§25-2-4, 12.)
- Swimming Pool Permits and Regulations (*See* O.C.G.A. §31-45-3, Rules and Regulations Chapter 290-5-57)

1.7.1.5 Latest Edition. The latest edition approved by the implementing agency of the regulations, rules, and codes listed in Sections 1.7.1.3 and 1.7.1.4 above, with all amendments as of the date of permitting for construction, shall govern the installation of all Work and is adopted and incorporated into the Contract Documents and made a part thereof by reference. However, the drawings and specifications shall be adhered to in all cases where they call for quality of materials, quality of workmanship, or quality of construction which is equal to or in excess of the quality required by the above-stated codes. It is also provided that there may be no variances from the drawings and specifications except to the extent that the said variances shall be necessary in order to comply with the above-stated codes. It shall be the responsibility of the Contractor to familiarize himself with the requirements of the above-stated codes. If there are any express requirements in the drawings or specifications that are at variance to the above-stated codes, all changes in the Work necessary to eliminate or add to the said requirements and make the Work conform to the above-stated codes shall be adjusted as provided in the Contract for changes in the Work.

1.7.1.6 Compliance with Executive Orders Concerning Ethics. The Contractor warrants that he and his firm have complied in all respects with the Governor's Executive Orders concerning ethics matters, including, but not limited to, Executive Order dated January 13, 2003 (establishing Code of Ethics for Executive Branch Officers and Employees, including provisions governing former officers and employees) and Executive Order dated October 1, 2003 (governing vendors to state agencies and disclosure and registration of lobbyists). In this regard, the Contractor certifies that any lobbyist employed or retained by the Contractor or his firm has both registered and made the required disclosures required by the Executive Orders, as amended.

1.7.1.7 Compliance with Federal and State Work Authorization and Immigration Laws. The Contractor and all Subcontractors and consultants must comply with all federal and state work authorization and immigration laws, and must, as a material condition of this Contract, certify compliance with O.C.G.A. §13-10-91 in strict accordance with Paragraph 23 of the Contract. The required Contractor's affidavit (Exhibit A) must be filed with the Owner at contract execution and shall become a part of this Contract. Required subcontractor affidavits must be obtained and maintained by the Contractor as of the beginning date of this contract and the beginning date of each subcontract or consultant contract. A copy of each such verification shall be provided to the Owner at the time the subcontractor or consultant is retained. State officials, including officials of the Owner, retain the right to inspect and audit the Project Site and employment records of the Contractor, its Subcontractors and consultants without notice during normal working hours until Final Completion, and as otherwise specified by law and by Chapter 300-10-1 *et seq.* of the Rules and Regulations of the Georgia Department of Labor.

1.7.2 Surveys, Permits, and Regulations. The Owner shall furnish all surveys unless otherwise specified. Permits and licenses of a temporary nature necessary for the prosecution of the Work shall be obtained and paid for by the Contractor. Permits, licenses, and easements for permanent structures or permanent changes in existing facilities shall be obtained and paid for by the Owner unless otherwise specified. The Contractor and its Subcontractors must pay any municipal or county occupational licenses, taxes, or fees, if any. The Contractor shall give all notices and comply with all laws, ordinances, rules, and regulations bearing on the conduct of the Work. If the Contractor observes that the drawings or specifications are at variance with any such laws, ordinances, rules or regulations, he shall promptly notify the Owner in writing, and any necessary changes shall be adjusted as provided in the Contract for changes in the Work. If the Contractor performs any Work knowing it to be contrary to such laws, ordinances, rules or regulations without such notice to the Owner, he shall bear all costs arising therefrom. Nothing in this paragraph shall be construed to impose design responsibility on the Contractor except as noted in the Contract Documents.

1.7.3 Open Records Act. Owner and Design Professional and Contractor acknowledge and agree that all records of the project and the Work, including records of Subcontractors, are subject to the Georgia Open Records Act, O.C.G.A. §50-18-70 et seq., with particular attention being called to O.C.G.A. §50-18-70(a) regarding the records of private persons, firms, corporations, or other private entity engaged in performance of services or functions on behalf of a state agency, public agency or public office.

1.7.4 Use of Site. The Contractor has a revocable license until the date of Material Completion to enter and perform Work upon the Premises, shall confine thereto his plant, his apparatus, the staging and storage of materials, the operations of his forces and the Work to limits indicated by law, ordinances, permits, or the Contract Documents, and shall not unreasonably encumber the Premises with his materials. The Contractor shall not load or permit any part of the Work to be loaded with weight that will endanger its safety. The Contractor shall enforce Contract requirements regarding signs, advertisements, fires, and smoking and shall remove from the Premises and properly dispose all trash and debris.

1.7.5 Office for Contract Compliance Specialist (CCS). The CONTRACTOR shall provide at his expense a temporary office, services, utilities, equipment, and supplies at the Site for the use of the CCS. The office shall be a minimum of 100 square feet in size; weather-tight; and shall be provided with heat, ventilation, cooling, electric lights, adequate windows, and securable access. The following services shall be provided: at least four dual-plugs 110 v. electrical outlets, local telephone and internet service [High Speed Access (DSL) where available]. The following equipment for the CCS's exclusive use shall be provided: a desk with drawers, two chairs, a four drawer metal file cabinet, a plan table and rack. The following items, which may be used in common with the CONTRACTOR's facilities, shall be provided: wet (flush) toilet, potable water and soap for hand washing, potable water suitable for drinking, access to fax machine and copier, and use of a room with table and chairs to accommodate meetings of a minimum of eight (8) people. The use of a temporary portable wet toilet with a holding tank is acceptable only when a sanitary sewer is not available on the Site. Toilet tissue and paper hand towels shall be provided at all times. At the completion of the project, all of the

equipment provided will be returned to the CONTRACTOR. The CONTRACTOR is not responsible for providing the following items for the CCS: computer equipment, long distance charges, stationery supplies, and personal safety equipment.

1.7.6 Utilities. Pending the extension and connection of permanent water, permanent gas, permanent sewer taps, and permanent electric power, the Contractor shall obtain temporary water, temporary gas, temporary electric power, and provide sewage disposal at his own expense. In the absence of provisions to the contrary, the Contractor shall pay for all utilities services until Material Completion has been achieved.

1.7.7 Royalties and Patents. The Contractor shall pay all royalties and license fees. (*See* Section 1.5.2.4).

1.7.8 Separate Contracts. The Owner reserves the right at any time and from time to time upon notice to Contractor to perform, or cause to be performed by other Contractors, other work at the Site in connection with the development of the Project that is not contemplated hereby or that is contemplated hereby if the Contractor and the Owner shall be unable to agree upon a Change Order incorporating such work as Work of the Contractor under this Contract. In either case, the Owner shall assure that such personnel or Contractors do not cause any conflict with the Work of Contractor. Contractor shall afford the Owner and other Contractors reasonable opportunity for the introduction, protection, and storage of material and equipment at the Site and the execution of work, and shall properly connect, if required by Contract Documents, and coordinate its work with theirs. If any work by the Owner or its other Contractors increases Contractor's costs or extends the time of performance, Contractor shall be entitled upon timely claim to a Change Order for payment by Owner of any reasonable costs actually incurred by Contractor as a result thereof and to an extension of time for performance for such reasonable time as the Design Professional shall determine. Contractor has no responsibility hereunder to certify the suitability or correctness of any work performed by Owner's own personnel or other Contractors under direct contract with the Owner. This Section also applies to installation of loose equipment and fixtures by the Owner, Using Agency, or a Separate Contractor.

1.7.9 Women and Disadvantaged Business Participation.

1.7.9.1 Good Faith Efforts. Contractor shall, to the extent consistent with quality, price, risk and other lawful and relevant considerations, use its good faith efforts to achieve participation by minority, women, and disadvantaged business enterprise participation in Work and services contracted to Contractor under this Contract.

1.7.9.2 Policy of the State of Georgia. It is the policy of the State of Georgia that minority business enterprises shall have the maximum opportunity to participate in the State purchasing process. Therefore, the State of Georgia encourages all minority business enterprises to compete for, win, and receive Contracts for goods, services, and construction. In addition, the State encourages all companies to sub-contract portions of any State Contract to minority business enterprises. It is the wish of the Owner that minority businesses be given the opportunity to propose on the various parts of the Work. This desire on the part of the Owner is not intended to restrict or limit competitive selection or to increase the cost of the Work. The Owner supports a healthy free market system that seeks to include responsible businesses and provides ample opportunity for business growth and development.

1.7.9.3 Minority Vendor Designee. The minority vendor designee of the Owner shall be specified in the Supplementary General Requirements or the Instructions to Bidders.

1.7.10 Assignment. The Contractor shall not assign the Contract or sublet it as a whole nor shall the Contractor assign any moneys due or to become due to him hereunder. Contractors may subcontract portions of the Work, normally performed by Subcontractors.

1.7.11 Interpretation of Contract Documents. The Contract Documents shall be construed neither against nor in favor of either party, but shall be construed in a neutral manner.

1.7.12 Counterparts. This Contract may be executed in multiple counterparts. All counterparts shall constitute one and the same instrument. One (1) counterpart of this Contract shall be delivered to the Owner and one (1) counterpart to the Contractor.

1.7.13 Forms and Specimens. The forms and specimens In Section 7 are incorporated by reference herein and shall be executed in substantial conformance as required or convenient in describing obligations under the Contract Documents.

1.7.14 Entire Agreement. The Contract Documents referenced herein constitute the entire Contract between the Owner and the Contractor with respect to the Project and supersedes all prior negotiations, representations, and agreements. Except as set forth herein, there are no other promises, understandings, agreements, representations or warranties, oral or written, expressed or implied between the parties. This Contract may not be changed, modified, or terminated, in whole or in part, nor any provision waived except by Change Order.

1.7.15 Energy Efficiency and Sustainable Construction Act of 2008. The following services are to be provided by the Contractor if this project is subject to the Georgia Energy Efficiency and Sustainable Construction Act of 2008 ("Energy Act"). See paragraph 9 of the Contract to determine if the Energy Act is applicable.

1.7.15.1 Georgia Based Materials and Products. The project is required to be designed so that not less than 10 percent of all building materials used in the project are materials that are harvested, extracted, or manufactured in the State of Georgia where such products are commercially available. The Contractor shall track the value of all Georgia based materials installed in the project. Contractor shall provide documentation to ensure compliance with the requirement and shall complete the Georgia-Based Materials and Products Checklist, attached as Exhibit B to certify compliance with the requirement.

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SECTION 2 – PRE-COMMENCEMENT PHASE

PART 1 – PRE-COMMENCEMENT PHASE SERVICES

2.1.1 Pre-commencement Coordination. As early as practicable and reasonably in advance of the commencement of Work on the Project, the Contractor shall schedule and conduct an initial construction coordination meeting for the purpose of determining and developing the appropriate and necessary processes and procedures for proper planning and coordination for the installation of all the Work. The meeting shall include all of the Subcontractors, and Suppliers materially involved in such installation of the Work. The Contractor shall assure that each necessary Subcontractor involved in performance of the Work shall be present and represented by a knowledgeable person with authority to reach agreement on the coordination procedures and processes involving its portion of the Work. The Owner shall be represented at this initial meeting by the Owner's Representative, and shall require that authorized and knowledgeable representatives of each of the separate disciplines in the design team, comprising the Design Professional and all Consultants contributing to the design preparation, shall also be present at the initial meeting. If necessary, additional meetings shall be scheduled by the Contractor with all of the affected parties to continue review and resolution of any real or apparent conflicts or interferences.

2.1.2 Construction Preparation Period.

2.1.2.1 Requirement for Project Planning. No physical work will begin on the construction site until the receipt of a Proceed Order issued by the Owner. The Contract assumes that a Proceed Order will be issued in not more than sixty days from the Effective Date of the Contract. Failure of the Contractor to provide the necessary documentation for the issuance of a Proceed Order shall not entitle the Contractor to any extension of time. If a Proceed Order is not issued within sixty days from the award of the Contract and non-issuance is due to nonperformance by the Contractor, the Contractor may be in default.

2.1.2.2 Timing of Submission of Documents. No Proceed Order shall be issued until the Owner has received, in good and proper order, the following documents. The documents shall be submitted in accordance with the following schedule:

2.1.2.2.1 Within ten days of the Notice of Apparent Successful Bid:

(a) Contract executed by Contractor
(b) Payment and Performance Bonds in accordance with Section 1 Part 5
(c) Proof of Insurance as required by Section 1 Part 5
(d) Georgia Security and Immigration Compliance Act Affidavit (Exhibit A)

2.1.2.2.2 Within fourteen days of the Effective Date of the Contract:

(a) List of intended Subcontractors

2.1.2.2.3 Prior to the issuance of the Proceed Order, but in any event, within sixty days of the Effective Date of the Contract:

(a) Submittal Schedule as required in Section 2.2.3
(b) Construction Progress Schedule as required in Section 2.1.5
(c) Documents Review Report as required in section 2.1.2.3
(d) Construction Management Plan as required in Section 2.1.3 including Security Program and Safety Program
(e) Documentation necessary for receiving all land disturbance permits, See Section 2.2.5
(f) Contractor's Quality Control Program as required in Section 2.1.4
(g) Written Safety Program as required in Section 1.4.7
(h) Contractor's establishment with the Owner of Unit Prices not already bid as required in Section 2.1.8
(i) Contractor's Certificate of Subcontractors' Workers' Compensation and Employer's Liability Insurance as required in Sections 1.5.3.3.1 and 1.5.3.3.2
(j) Subcontractors' Affidavit for Georgia Security and Immigration Compliance as required in Exhibit A.

2.1.2.3 Document Review and Verification. Within one business day of receipt of the Effective Date of the Contract, Contractor shall commence a review of the plans and Specifications, to identify conflicts, omissions, or constructability issues in the documents. Contractor shall prepare a report containing a list of issues and suggested modifications identified. He shall provide a copy of the report to the Design Professional and the Owner prior to the end of the Construction Preparation Period.

2.1.3 Construction Management Plan. Contractor shall prepare and furnish to the Owner a thorough and complete plan for the management of the Project from issuance of the Proceed Order through the issuance of the Design Professional's Certificate of Material Completion. Such plan shall include, without limitation, an estimate of the manpower requirements for each trade and the anticipated availability of such manpower, a schedule prepared using the critical path method that will amplify and support the schedule required in Section 2.1.5 below, and the Submittal Schedule as required in Section 2.2.3. The Contractor shall include in his plan the names and resumes of the Project Superintendent, Project Manager and the person in charge of Safety.

2.1.3.1 Security Program. Develop and implement an effective security program for the Project Site, which program shall require the Contractor and subcontractors to take measures for the protection of their tools, materials, equipment, and structures. As between Contractor and Owner, Contractor shall be solely responsible for security against theft of and damage to all tools and equipment of every kind and nature used in connection with the Work, regardless of by whom owned.

2.1.3.2 Safety Program. The Contractor shall design and submit to the Owner a specific safety program for the Work for the site(s). The Contractor shall establish and require all Subcontractors to establish reasonable safety programs. The Contractor shall also submit its standard monthly safety reports to the Owner and Design Professional. No imposition of responsibility on the Contractor for safety under this Contract shall relieve any subcontractor of its responsibility for safety of persons or property on or near the Project Site. The Contractor shall include in his plan the names of the person in charge of Safety.

2.1.3.3 Certificate of Competency – Fire Protection Trade Contractor. If a fire protection sprinkler system is required, the CONTRACTOR shall submit to the Owner and Design Professional the certificate of competency of the fire protection sprinkler system Trade Contractor as required by State of Georgia Fire Protection and Safety Code. The certificate of competency shall be provided prior to any work being performed on the fire protection sprinkler system.

2.1.4 Quality Control Program.

2.1.4.1 Responsibility for Quality of Materials and Installation. Contractor acknowledges that he has full, total, and complete responsibility for providing materials, labor, and all other items necessary for providing the level of quality specified in the Contract Documents. He agrees that this responsibility is indivisible, non-delegable, non-transferable, and not diminished by any inspections provided by the Design Professional or his consulting engineers, nor by any inspections provided by the Owner. In recognition of this, Contractor will prepare for submission and review by the Design Professional, a written program describing the efforts that will be taken to insure the proper quality level is achieved.

2.1.4.2 Written Program. Contractor's written Quality Control Program shall describe in detail the steps the Contractor will take to ensure quality and will include, without limitation, those personnel, in addition to the Superintendent, who will provide review and verification of the proper installation of the Work. Each Subcontractor having responsibility for more than $50,000 of the contract cost shall be addressed in the plan. The written program shall include affidavits from each of the involved Subcontractors acknowledging their responsibilities under the Contract in general and the Quality Control Program specifically.

2.1.5 Construction Progress Schedule; Overall Project Schedule. The Contractor shall submit within sixty days after the Effective Date of the Contract for review by the Design Professional and approval by the Owner a Construction Progress Schedule. The Construction Progress Schedule shall be prepared using a CPM (Critical Path Method) process, utilizing a full-featured software package in a form satisfactory to the Design Professional and Owner, showing dates for preparation and processing of shop drawings and samples, and delivery of materials or equipment requiring long lead-time procurement, proposed date of Material

Completion and Owner's occupancy requirements. It should also include the dates for commencement and completion of the Work required by the Contract Documents, including coordination of mechanical, plumbing, and electrical disciplines, as well as coordination of the various subdivisions of the Work within the Contract. Milestones must be clearly indicated and sequentially organized to identify the critical path of the Project. The Construction Schedule will be developed to represent the CSI specification divisions. It shall have the minimum number of activities required to adequately represent to the Owner the complete scope of Work and define the Project's critical path and associated activities. The format of the Construction Progress Schedule will have dependencies indicated on a monthly grid identifying milestone dates such as construction start, phase construction, structural top out, dry-in, rough-in completion, metal stud and drywall completion, equipment installation, systems operational, inspections for Material Completion, the Material Completion Date and the Final Completion Date. The Contractor shall submit, along with the Construction Progress Schedule, the Submittal Schedule for approval by the Design Professional, correlating the associated approval dates for the documents with the Construction Progress Schedule. Upon recommendation by the Design Professional and approval by the Owner, the Construction Progress Schedule shall become the Overall Project Schedule, which shall be utilized by the Design Professional, Owner and Contractor. The Contractor must provide the Design Professional and the Owner with monthly updates of the Overall Project Schedule indicating completed activities and any changes in sequencing or activity durations. However, no changes in milestone dates are to be made without consent of the Owner and Design Professional which includes approved change orders.

2.1.6 Progress Reports and Information. When required, the Contractor shall submit to the Owner such schedule of quantities and costs, payrolls, bills, vouchers, correct copies of all subcontracts, statements, reports, correct copies of all agreements, correspondence, and written transactions with the surety on the performance bond that have any relevance to the Work, estimates, records, and other data as the Owner may request that concerns the Work performed or to be performed under this Contract. When requested by the Owner, the Contractor shall give the Owner access to its records relating to the foregoing. (*See also* Section 1.2.3, Audits.) The above reports shall include, but are not limited to, (a) written notice of dates by which specified Work will have been completed, (b) written notice of dates by which Non-Compliant Work will be made good, (c) written notice that Non-Compliant Work has been made good, (d) written notice as to the date or dates by which Work that has not been performed with equal steps and at the same rate required by the Overall Project Schedule shall have been brought into conformity with the Overall Project Schedule, (e) date by which any undisputed claim of a Subcontractor, Supplier, or laborer shall have been paid, (f) written advice regarding the nature and amount of any disputed claim of a Subcontractor, Supplier, or laborer, and (g) information regarding Work performed under Change Orders.

2.1.7 Building Commissioning Services. The Owner may provide either through: (i) a separate contract, (ii) as an additional service of the Design Professional, or (iii) as a separate contract issued by the Using Agency, the Building Commissioning services involving the project's HVAC and exhaust systems, temperature control systems, fire detection and alarm systems, emergency power and lighting system, fire suppression system, security locks and security locking control systems, food service equipment (if applicable), and laundry equipment (if applicable). It is the intent of this Section that the Commissioning Authority engaged for this Project enforce the requirements mentioned herein and certify that the systems and equipment listed all function properly prior to Material Completion.

2.1.7.1 Initial Building Commissioning Plan. The Owner shall develop with its Commissioning Authority, the Contractor and the Design Professional, an initial Building Commissioning plan to consist of the following:

2.1.7.1.1 The Building Commissioning Plan shall include a summary of understanding of the design intent for each of the relevant building systems (including clean room systems and infrastructure, if applicable) and equipment. Each design intent summary shall establish critical performance criteria that indicate whether a system is properly functioning.

2.1.7.1.2 The Building Commissioning Plan shall include a commissioning schedule listing the duration of each commissioning activity such as system and equipment manual submittal and approval, equipment start-up, and system and equipment training, and combining all such activities in a manner reflecting the inherent subsidiary relationships between activities. This schedule shall be used as a basis for accomplishing the commissioning portion of the Overall Progress Schedule.

2.1.7.2 Define Duties. The Contractor, in coordination with the Commissioning Authority and the Design Professional, shall clearly define all duties and activities required of the various Trade

Contractors relating to Building Commissioning, any necessary order in which these activities and duties must take place, and define all critical performance criteria to be achieved.

2.1.7.3 Inspect, Review and Monitor. The Commissioning Authority shall inspect, review and monitor all Building Commissioning related construction activities for timeliness, completeness and conformance with the criteria established by the contract documents, and report same to the Contractor, Owner and the Design Professional. The Contractor and Commissioning Authority shall coordinate and supervise the training activities of each system.

2.1.8 Unit Prices.

2.1.8.1 During Construction Preparation Period. Prior to the issuance of a Proceed Order, the Contractor shall establish with the Owner Unit Prices not already bid. Examples include additional installation of storm water management BMPs, any other anticipated Change Order Work that can utilize Unit Prices, or for any items of Work considered necessary by the Design Professional and not established in the Contract Documents.

2.1.8.2 During Construction. Upon request of the Owner the Contractor shall submit written proposals for unit prices to be applied in the event Change Order Work is authorized by the Owner to be performed under Unit Price or Force Account Authorization.

2.1.8.3 Calculation of Unit Prices. Unit Prices include all sums for payment, repayment, reimbursement, remittance, remuneration, compensation, profit, cost, overhead, expense, loss, expenditure, allowance, charge, demand, hire, wages, salary, tax, cash, assessment, price, money, bill, statement, dues, recovery, restitution, benefit, recoupment, exaction, or injury. Unit prices to cover the addition or reinstallation of storm water management BMPs shall be calculated by type and linear foot. Unit Prices *shall not* include any delay costs, as such costs may be added pursuant to Section 3, Part 3. The Contractor shall certify that the Unit Prices submitted do not exceed current costs in the industry or trade for like services or materials.

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PART 2 – CONSTRUCTION DOCUMENTS AND SITE PLAN

2.2.1 General Provisions Regarding Construction Documents.

2.2.1.1 Familiarity with Contract Documents. The execution of the Contract constitutes a representation by the Contractor that it has reviewed, carefully examined, studied, and analyzed the Contract Documents.

2.2.1.2 Identification of Construction Documents. The Design Professional shall identify the Construction Documents, which shall include, but are not limited to, the Specifications, the Drawings, and all Addenda. The Construction Documents are included within the Contract Documents.

2.2.1.3 Correlation and Intent. It is the intention of the Owner, Design Professional, and Contractor that the Construction Documents include all items necessary for proper execution and full and final completion of the Work. The Contract and Construction Documents (the Contract Documents) are complementary, and what is required by one is as binding as if required by all. Performance by the Contractor is required to the extent consistent with and reasonably inferable from the Contract Documents as being necessary to produce the design intent as expressed in the Contract Documents. The intention of the Owner and the Design Professional is that the Contract and Construction Documents include all labor and materials, equipment, and transportation necessary for the proper execution of the work. It is not intended, however, that materials or work not covered by or properly inferable from any heading, branch, class, or trade of the specifications shall be supplied unless noted on the drawings.

2.2.1.4 Arrangement. of Specifications. The Specifications are separated into numbered and titled divisions for convenience of reference. Neither the Owner nor the Design Professional shall assume any responsibility for defining the limits of any subcontracts on account of the arrangement of the Specifications. Notwithstanding the appearance of such language in the various divisions of the Specifications as, "The Plumbing Contractor," "The Electrical Contractor," "The Roofing Contractor," etc., the Contractor is responsible to the Owner for the entire Contract and the execution of all of the Work referred to in the Contract Documents. No partial sets of Bidding Documents shall be issued by the Design Professional. Any partial documents issued by the Contractor shall be the responsibility of the Contractor.

2.2.1.5 Conflicts. The following general principles shall govern the settlement of disputes that may arise over conflicts in the Contract Documents: (a) as between figures given on drawings and the scaled measurements, the figures shall govern; (b) as between large-scale drawings and small-scale drawings, the larger scale shall govern; (c) as between the Contract and the Specifications, the requirements of the Contract, as executed, shall govern. Conflicts noted shall be reported to the Design Professional. The principles set forth herein shall not alter the provisions of section 1.1.7.1. Schedules, lists, indexes, tables, inventories, written instructions, written descriptions, summaries, statements, classifications, Specifications, written selections, or written designations, although appearing on the drawings, are deemed to be and are Specifications; (d) as between specifications and drawings, the requirements of the specifications shall govern. (*See also* Section 1.1.7.1)

2.2.1.6 Requests for Information (RFI). In the event the Contract Documents are not complete, definite, and clear, the Contractor shall request the Design Professional in writing for additional instructions and shall furnish the Owner a copy of the RFI. With reasonable promptness but not more than five days thereafter, the Design Professional shall furnish complete, definite, and clear instructions in writing, or by means of drawings, or both. In the event such additional instructions are given orally for expediency, they shall be confirmed in writing or by drawings or both within five days following the oral instructions. Any such additional instructions shall be consistent with the Contract Documents and reasonably inferable therefrom. The Work shall be executed in conformity with the aforesaid instructions. The Design Professional shall furnish the Owner a copy of all additional instructions issued to the Contractor. If, because of events beyond its reasonable control, the Design Professional is not able to meet the specified time period, then it is entitled to ask for additional time from the Owner.

2.2.1.7 Effect of Addenda, Bulletins, and Change Orders. No special implication, interpretation, construction, connotation, denotation, import, or meaning shall be assigned to any provision of the Contract Documents because of changes created by the issuance of any (1) Addendum, (2) Bulletin, or (3) Change Order other than the precise meaning that the Contract Documents would have had if the provision thus created had read originally as it reads subsequent to the (1) Addendum, (2) Bulletin, or (3) Change Order by which it was created.

2.2.1.8 Intellectual Property Rights in Construction Documents, Drawings, and Models. The drawings, Specifications and other documents prepared by the Design Professional pursuant to this Contract (including, without limitation, the Construction Documents), are the property of the Owner, whether or not the Project for which they are made commences or completes construction. Neither the Contractor nor any Subcontractor or material or equipment supplier shall own or claim a copyright in such drawings, Specifications, and other similar or related documents; Owner shall retain all common law, statutory, and other intellectual property rights with respect thereto. The Contractor must deliver remaining copies of such documents to the Owner upon request or upon completion of the Work, except that the Contractor may keep one copy of such documents for its files. The Contractor shall only use such drawings, Specifications and other documents for this Project. Neither the Contractor nor any Subcontractor or material or equipment supplier may use such drawings, Specifications, and other documents on other projects without the specific written consent of the Owner. All models are the property of the Owner.

2.2.2 Documents at the Project Site.

2.2.2.1 Drawings and Specifications at the Project Site. The Contractor shall keep at the Site at least one copy of the Contract Documents and Change Orders, all in good order and available to the Design Professional and to his representatives.

2.2.2.2 Recording Changes. The Contractor shall record all changes and shall annotate a copy of the drawings to reflect the as-built condition as required by Section 6, Part 2..

2.2.3 Submittals. Submittals required by the Contract Documents shall be prepared specifically for the Work by the Contractor to illustrate some portion of the Work. Submittals are not Contract Documents unless approved in writing by the Design Professional.

2.2.3.1 Submittal Schedule. Within sixty days after receipt of the Effective Date of the Contract, the Contractor shall prepare and submit a Submittal Schedule for review and approval of the Design Professional. In establishing the Submittal Schedule the Contractor shall take into account large submittal documents that will require longer review times, e.g., submittals with over fifty sheets of drawings. The Design Professional's approval shall be based on conformance of the Submittal Schedule with the Overall Project Schedule, subject to change from time to time in accordance with the progress of the Work.

2.2.3.2 Submission and Approval. The Contractor's Submittals must comply with the Contract Documents. The Contractor shall review and approve all Submittals prior to submission. The Contract Documents shall specify when shop drawings or submittals require the seal of a specialty consultant. The Contractor shall submit copies of Submittals as required by the Contract Documents for the Work of the various trades. The Design Professional shall review, approve, or take other appropriate action with respect to shop drawings, samples, or other submissions of the Contractor, including, but not limited to, confirming conformance with the design concept of the Project and with the Contract Documents. The Design Professional shall respond to and return said items to the Contractor within fourteen calendar days from receipt provided that the Submittals are submitted by the Contractor in accordance with the required Submittal schedule. The Design Professional shall review and give comment or approval to Submittal schedule within fourteen calendar days from receipt. Large submittal documents may require longer review times, e.g., submittals with over fifty sheets of drawings. If, because of events beyond its reasonable control, the Design Professional is not able to meet the specified time period, then it is entitled to ask for additional time from the Owner. The Contractor shall make all corrections required by the Design Professional and furnish such corrected copies as may be needed. If the Contractor believes that any corrections required by the Design Professional constitute a change to the contract, the Contractor shall immediately notify the Design Professional and Owner and request instructions. By forwarding the approved Submittals to the Design Professional, the Contractor represents that the Contractor has determined and verified

materials, field measurements, and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such Submittals with the requirements of the Work and of the Contract Documents. The Design Professional's approval of Submittals shall not relieve the Contractor from the responsibility for errors of any sort in Submittals or schedules. The Contractor shall perform no portion of the Work for which the Contract Documents require Submittals until the Design Professional has approved the respective Submittal. The Contractor shall maintain at the Site one copy of all approved Submittals.

2.2.3.3 Cost of Additional Review. The Design Professional shall be responsible for an initial and one subsequent review of the Submittal. Where the subsequent Submittal is not accepted due to noncompliance with the Contract Documents, the Contractor shall be responsible for payment for the additional time required by the Design Professional to complete the Submittal review. The cost of such additional reviews shall be the responsibility of the CONTRACTOR.

2.2.4 Manufacturer's Recommendations. All work or materials shall be installed in accordance with the Contract Documents and the manufacturer's recommendations, requirements and reference standards. The CONTRACTOR shall obtain the manufacturer's recommendations, requirements and reference standards for its use at the Site in executing the Work. Manufacturer's recommendations shall include copies of bulletins, circulars, catalogues, or other publications bearing the manufacturer's titles, numbers, editions, dates, etc. Reference standards include standards promulgated by the agency of the standard as referenced in the plans, specifications and applicable building codes. If the manufacturer's recommendations or reference standards are not available, the CONTRACTOR shall request instructions from the Design Professional.

2.2.5 Site Plan.

2.2.5.1 General. The Design Professional is responsible for providing the initial sealed Site Plan as a part of the Bidding Documents. During the Pre-Commencement phase, the Contractor shall review the initial Site Plan and make and submit recommendations for any changes to the initial Site Plan. The Contractor is required to obtain the land disturbance permit(s) applicable to the Owner that implement the National Pollution Discharge Elimination System (NPDES) requirements for storm water management for construction activities from the appropriate issuing authority. Compliance requires that there be properly designed Best Management Practices (BMPs), properly installed BMPs, and inspection and maintenance of the installed BMPs.

2.2.5.2 Implementation. The Design Professional will depict upon the Site Plan its initial recommendations as to elements of the erosion, sedimentation, and pollution control plan, specifying his recommended design of BMPs for the Project, including storm water management facilities, and other like matters. It is the Contractor's responsibility to review the design of the BMPs and submit any changes to the plan, including the Contractor's desired use of entrances to the Site, Contractor's trailer(s) location, laydown areas and other similar matters affecting the design and implementation of the BMPs. The Design Professional and Contractor shall arrive at a final sealed Site Plan for submission to the permitting officials that enables the land disturbance permitting of the Project. The Design Professional and Contractor shall resolve with the local permitting official any deficiencies by the end of the Pre-commencement period.

2.2.5.3 Installation, Inspection, and Maintenance. The Contractor is responsible for installation and maintenance of the BMPs as a part of its Bid. The Design Professional shall obtain the services of a qualified testing laboratory to inspect the BMPs in accordance with the permits, the costs of such inspections to be borne by the Owner. In the event Abnormal Weather Conditions or *force majeure damage the BMPs*, the Contractor shall be compensated for repair or re-installation of BMPs at established Unit Prices, where such repair or reinstallation is not covered by insurance supplied by the Contractor.

2.2.6 Geological and Archeological Specimens. If, during the execution of the Work, the Contractor, any Subcontractor, or any servant, employee, or agent of either should uncover any valuable material or materials, such as, but not limited to, treasure trove, geological specimens, archival material, archeological specimens, or ore, the Contractor acknowledges that title to the foregoing is vested in the Owner. The Contractor shall notify the Owner upon the discovery of any of the foregoing, shall take reasonable steps to safeguard it, and seek further instruction from the Design Professional. Any additional cost incurred by the Contractor shall be addressed under the provision for changed conditions. The Contractor agrees that the Geological and Water Resources Division and the Historic Preservation Division of the Georgia Department of Natural Resources may inspect the Work at reasonable times.

SECTION 3 – CONSTRUCTION PHASE

PART 1 – CONSTRUCTION PHASE SERVICES

3.1.1 Basic Construction Services.

3.1.1.1 Requirement to Commence Work. Time being of the essence of this Contract, and a material consideration thereof, it is mutually agreed by the parties hereto in case of the Contractor's failure to complete the construction within the time specified, the Owner will be damaged thereby. The Contractor shall commence performance of its activities as of the date specified in the Proceed Order. The Contractor shall complete construction, except for Minor Items and Permitted Incomplete Work (Scheduled Warranty Items) (*see* Section 6.1.1), not later than the Material Completion Date, as adjusted by Change Order.

3.1.1.2 Payment for Services and Work. Unless otherwise stipulated, the Contractor shall provide and pay for all materials, supplies, labor, services, water, tools, equipment, light, power, transportation, and other utilities and facilities necessary for the proper execution and completion of the Work.

3.1.1.2.1 No Obligation of Owner. Contractor shall not enter into, execute, or deliver any agreement, document, or undertaking, or incur any obligation with any Trade Contractor, Supplier or Subcontractor in the name of the Owner.

3.1.1.2.2 No Conditional Sales Agreements. Contractor shall not make, cause to be made, or permit, any contract for materials or equipment of any kind or nature whatsoever to be used in connection with the Work on a conditional sales or any other basis whereby the title to the equipment or materials does not pass to the Owner upon delivery to the Site or incorporation in the Project, free and clear of any lien, financing arrangement, or other impediment to title.

3.1.1.2.3 Separate, Distinct, and Independent Covenants. The covenants of this Section are separate, distinct, and independent covenants and no default by the Owner under the terms of this Contract shall relieve or release Contractor of and from the covenants set forth in this Section.

3.1.1.3 Quality of Materials and Workmanship. Unless otherwise specified, all materials shall be new, and both workmanship and materials shall be of good quality. The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials and work. The burden of proof is on the Contractor.

3.1.1.4 Quality and Discipline of Employees. The Contractor shall at all times enforce strict discipline and good order among his employees and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him.

3.1.1.5 Failure of the Contractor to Supply Workmen. A Notice of Non-Compliant Work may be issued for failure of the Contractor to supply enough workers or enough materials or proper materials.

3.1.1.6 Superintendence and Supervision by Contractor.

3.1.1.6.1 Supervision by Contractor. The Contractor shall give efficient supervision to the work, using his best skill and attention. He shall carefully study and compare all drawings, specifications, and instructions and shall at once report to the Design Professional any error, inconsistency, or omission that he may discover, but he shall not be held responsible for their existence or discovery.

3.1.1.6.2 Supervision of Contractor. The Contractor shall keep on this work during its progress and until the Final Certificate has been executed by the Design Professional a competent Project Superintendent and any necessary assistants, all satisfactory to the Design Professional and Owner. The Project Superintendent shall not be changed except with the consent of the Owner and the Design Professional unless the superintendent proves to be unsatisfactory to the Contractor and ceases to be in his employ. The superintendent

represents the Contractor and all directions given to the superintendent shall be as binding as if given to the Contractor.

3.1.1.6.3 Replacement Project Superintendent. If the Contractor terminates the Project Superintendent or, if the Contractor, for any reason, engages a Project Superintendent different from the one originally assigned to the Project, Contractor must ensure that the replacement Project Superintendent has similar qualifications and experience as the originally identified Project Superintendent. Furthermore, the Contractor must obtain the Owner's prior written approval before engaging a permanent replacement Project Superintendent.

3.1.1.6.4 Competent Staff. The Contractor shall maintain at the Site a competent staff with appropriate expertise to coordinate and provide general direction of the Work in order to (i) Conduct adequate control of the Work as to quality and compliance with the Contract Documents, and (ii) Maintain satisfactory progress by any Subcontractors involved in the performance of the Work.

3.1.1.6.5 Coordination. Establish with the Design Professional procedures for coordination among the Owner, the Design Professional, and the Contractor. Establish similar procedures for coordination between Contractor and its Subcontractors and Suppliers with respect to all aspects of the Project, and implement such procedures.

3.1.1.6.6 Qualified Workforce and Sufficient Staff. CONTRACTOR shall require all Trade Contractors, Subcontractors, and Suppliers to employ only skilled workmen properly qualified by experience and ability to perform the task assigned to them. In addition, Trade Contractors and Subcontractors shall employ and assign to the Work, at all times, sufficient staff and personnel to perform their subcontracted services in a skilled, professional, and satisfactory manner so as not to delay the progress of the Work. The CONTRACTOR shall immediately replace or cause to be replaced all Workmen whose Work, as determined by the CONTRACTOR, does not meet such requirements.

3.1.2 Measurements and Dimensions. Before ordering material or doing work that is dependent upon coordination with building conditions, the Contractor shall verify all dimensions, elevations, grades, and pitch by taking measurements at the building and shall be responsible for the correctness of same. Any discrepancies between the drawings and/or specifications and the existing conditions shall be referred to the Design Professional for additional instructions before any work affected thereby is begun.

3.1.3 Rain Water, Surface Water, and Back-up. The Contractor shall protect all Work, including but not limited to, excavations and trenches, from rainwater, surface water, and back up of drains and sewers. The Contractor shall furnish all labor, pumps, shoring, enclosures, and equipment necessary to protect and to keep the Work free of water.

3.1.4 Dust Control. Dust-proof enclosures or partitions for protection wherever dusty or dirty work is performed and dampening of debris to avoid dusting when removed shall be provided and included as a cost of the work.

3.1.5 Cutting, Patching, and Fitting. The Contractor shall do all cutting, patching, and fitting of the Work that may be required to make its several parts come together properly and fit.

3.1.6 Space Conditions. All pipes passing through floors, walls, and ceilings shall be installed with sufficient space between them to permit installation of pipe insulation and floor, wall, and ceiling plates without cutting of insulation or plates. Roughing dimensions shall be prepared by the Contractor to accomplish this requirement. The Contractor shall locate all equipment that must be serviced, operated, or maintained in fully accessible positions. This provision includes but is not limited to valves, traps, cleanouts, motors, controllers, switchgear, drain points, filter, access doors, and fire dampers. If spaces, dimensions, or other design conditions do not permit compliance with the present Section, the Contractor shall file a request in writing with the Design Professional for additional instructions, furnishing a copy to the Owner.

3.1.7 Cleaning Up. .

3.1.7.1 During Construction. At all times, the Contractor shall keep the premises free from accumulations of waste material or rubbish caused by his employees, subcontractors, or work. Periodically during the course of the Work he shall remove all his rubbish from and about the building

and all his tools, scaffolding, and surplus materials and shall leave his work "broom-clean" or its equivalent, unless more exactly specified. Prior to completion of any subcontract, Contractor shall require the subcontractor to remove from the Work and Site all temporary systems, tools, equipment, machinery, and surplus materials not required for the continued performance of any Work under this Contract.

3.1.7.2 Prior to Material Completion. Prior to the inspection for Material Completion of the Project, Contractor shall remove from the Site all wastes and rubbish, clean all tile and glass surfaces, replace broken glass, remove stains, paint spots, and clean and polish all plumbing fixtures and equipment, leave the Work *"vacuum clean"* or its substantial equivalent, all hard surface floors swept and mopped, all carpeted floors vacuumed, all surfaces other than floors dusted, blower dusted, or wiped (depending on type of surface) and any surface blemishes cleaned, all glazing washed [both sides], and all electrical and mechanical equipment and fixtures cleaned, with all ductwork cleaned and filters replaced, if such are dirty before other cleaning is started, and re-cleaned if any dust or dirt has gotten into the ductwork during the cleaning process. The Contractor shall restore existing facilities such as roads, other paved surfaces, fencing, curbing and the like at the Site to at least their preconstruction conditions; provided, however, the Contractor may, in an orderly fashion, leave such equipment and supplies at the Site as necessary to achieve Final Completion of the Project. This cleaning must be completed before the Contractor can expect the Design Professional to commence the inspection for Material Completion. To achieve Material Completion, the Contractor shall have fully cleaned the Site – all debris must have been removed from the site and all paved surfaces must have been broom swept and thoroughly hosed down.

3.1.8 Duty of Contractor to Report Defects. If any part of the Contractor's work depends for proper execution or results upon the work of any Separate Contractor to the Owner, the Contractor shall inspect and promptly report to the Design Professional any apparent defects in such work that render it unsuitable for such proper execution and results.

3.1.9 Duty of Contractor to Report Conflicts. To ensure the proper execution of his subsequent work, the Contractor shall measure work already in place and shall at once report to the Design Professional any discrepancy between the executed Work and the drawings or specifications.

3.1.10 Notice of Commencement. The Contractor shall, in accordance with Georgia law, record and post a Notice of Commencement for the construction portion of the Work, and shall promptly deliver a stamped-recorded copy of such Notice of Commencement to the Owner and Design Professional.

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PART 2 – CHANGES TO THE WORK

3.2.1 Acknowledgement of Existing Physical Conditions. In undertaking the work under this Contract, the Contractor acknowledges that he has visited the premises and has taken into consideration all open and apparent conditions that might affect his work. No claim based on lack of knowledge of existing conditions shall be allowed unless the existing physical conditions cannot be discovered by a reasonably observant person. Any claims relating to conditions that are materially different from the Contract Documents that were not open and apparent may be adjusted as provided in this Part.

3.2.2 Owner's Right to Make Changes. Without invalidating the Contract, the Owner, by Change Order and without notice to the sureties, may authorize or order extra work or changes by altering, adding to, or deducting from the Work or the Contract Time, the Contract Sum being adjusted accordingly. All Change Orders shall be performed under the conditions of the original Contract except that any claim for extension of time caused thereby shall be adjusted, if required, at the time of signing of the Change Order. (See Change Order formats in Section 7.) Should any designee authorized to accept and approve changes to the Contract Sum or limits of any designee's authority change during the time this Contract is in effect, the Contractor or Owner shall give written notice to the other as provided in Section 1.1.5. There is no legal limitation on the Owner's right to make changes such as may be, in the Owner's sole discretion, useful or desirable to the Project.

3.2.3 Changes Forbidden without Consent of Owner. Neither the Design Professional nor the Contractor shall make any change whatsoever in the work without an approved Change Order. In the absence of an approved Change Order, the Contractor shall have no claim for payment, repayment, reimbursement, remittance, remuneration, compensation, profit, cost, overhead, expense, loss, expenditure, allowance, charge, demand, hire, wages, salary, tax, cash, assessment, price, money, bill, statement, dues, recovery, restitution, benefit, recoupment, exaction, injury, damages, or time based upon or resulting from any change. The provisions of this Section do not apply to emergencies as described in Section 1.4.4.

3.2.4 Form and Execution of Change Orders.

3.2.4.1 The Change Order. The Change Order is the written instrument by which adjustments in the Contract Sum and the Contract Time are effected. The Change Order shall be accompanied by a breakdown as set forth in the Paragraph below. The breakdown is for the purpose of enabling the Design Professional and the Owner to make a judgment on the dollar amount of the adjustment in the Contract Sum and is not a part of the Change Order. No condition, term, qualification, limitation, exception, exemption, modification, or proviso, except as set forth in this Part, shall appear in the breakdown. Only such conditions, terms, qualifications, limitations, exceptions, exemptions, modifications, and provisos as are permitted under this Part are valid. The Design Professional shall certify to the dollar amount and description of the adjustments permitted by the Change Order.

3.2.4.2 Execution of Change Orders. Change Orders shall be signed by the Contractor, ordinarily certified by the Design Professional, and approved by the Owner in accordance with the form of Change Order prescribed by the Owner. No request for payment by the Contractor for a Change Order shall be due, nor shall any such request appear on an Application for Payment, until the Change Order is executed by the Owner. In the event of emergency (*see* Section 1.4.4) or significant impact to the Overall Project Schedule, the Owner shall direct the Change Order to proceed upon a Force Account until the cost and time is resolved in the manner set forth in Section 3.2.7.3 below.

3.2.4.3 Disagreement between Design Professional and Contractor.

3.2.4.3.1 As to Contract Sum. Should the Design Professional disagree with the Contractor as to the amount of the adjustment to the Contract Sum and such disagreement is not resolved between them within seven days, the Owner, if it desires the Change Order work to proceed, may direct the Work to commence on a proposed Change Order by Force Account.

3.2.4.3.2 As to Contract Time. Should the Design Professional disagree with the Contractor as to the amount of the adjustment to the Contract Time and such disagreement not be resolved between them within seven days, the dispute shall be resolved by the Owner as set form in Section 5 Part 2.

3.2.4.3.3 As to Other Disagreements. Should the Design Professional disagree with the Contractor as to matters other than Contract Sum or Contract Time, the dispute shall be resolved by the Owner as set forth in Section 5, Part 2.

3.2.4.4 Change Order Conditions. All Change Orders are issued under the following conditions:

3.2.4.4.1 For Lump Sum Change Order: The payment and extension of time, if any, provided by this Change Order constitutes compensation in full to the Contractor and its Subcontractors, Suppliers, and for all costs and markups, directly and indirectly attributable to the changes ordered herein, and for all delays related thereto and for any performance of changes within the time stated.

3.2.4.6.2 For Force Account Authorizations (In-part Change Order): If the Contractor requests payment on account of the Force Account authorization before the work has been completed, the Owner will issue an in-part Change Order. The payment and extension of time (if any) provided by this Change Order constitutes interim compensation to the Contractor and its Subcontractors and Suppliers for actual costs and markups directly and indirectly attributable to the Force Account authorization, for all delays related thereto and for performance of changes within the time stated.

3.2.4.5.3 For All Change Orders: Any changes or reservations by the Contractor to the representations and releases in the Change Order, or refusal of the Contractor to execute the Change Order, shall be a material breach of this Contract that may be sufficient cause to issue a declaration of default.

3.2.5 All Cost and Time Impacts to be Included. Each Change Order shall include all time and monetary impacts of the change. Failure to include a change in Contract Time or in Contract Sum in Change Orders shall be considered a zero price/zero time Change Order and shall waive any change in Contract Time and Contract Sum. Commencement of Work upon a Change Order is conclusive proof that the Contractor accepts the Change Order.

3.2.6 Changes in Contract Time. All Change Orders must state that the Contract Time and the Material Completion Date either are not changed or are increased or decreased by a specific number of Days. The Contractor must provide written justification for the extension to the Design Professional and to the Owner. The written justification must demonstrate an anticipated actual increase in the time required to complete the Work beyond that allowed by the Contract as adjusted by prior Change Orders to the Contract. No extension to the Contract Time shall be allowed unless the additional or changed Work increases the length of the critical path beyond the Material Completion Date. If approved, the increase in time required to complete the Work shall be added to the Contract Time. The Owner may decrease, by Change Order, the Contract Time when an Owner-requested deletion from the Work results in a decrease in the actual time required to complete the Work as demonstrable on the Construction Progress Schedule.

3.2.7 Determining the Cost to Owner for Changes. The cost to the Owner of any change shall be determined in one of the following three ways:

3.2.7.1 Lump Sum. The Change Order cost is determined by mutual agreement as a lump sum amount changing the Contract Sum allowed for completion of the Work. The Change Order shall be substantiated by documentation itemizing the estimated quantities and costs of all labor, materials and equipment required as well as any mark-up used. The price change shall include the cost percent allowed for the Contractor's, Subcontractor's and second tier subcontractor's overhead and profit as allowable (*See* Section 3.2.8).

3.2.7.2 Unit Price Work. The Change Order cost is calculated by using unit prices and calculating the number of net units of Work in each part of the Work that is changed before Work on the change commences, and by then multiplying the calculated number of units by the applicable unit price set forth in the Contract or multiplying by a mutually agreed unit price if none was provided in the Contract. No additional percentage markup for overhead or profit shall be added to the unit prices as this markup is included within the unit prices subject to the limitations of Section 3.2.8.

3.2.7.3 Force Account. The Change Order cost is accomplished by Force Account in the event the quantity of the Work or cost cannot be reasonably determined or agreed prior to beginning the Work.

3.2.7.3.1 A Force Account is authorized by the establishment of an Owner's Incumbrance Record which includes (a) the Design Professional's description of the scope of work, (b) the maximum dollar amount (Stipulated Maximum Sum) beyond which no changed work may be undertaken, subject to amendment, for funding all costs of the Force Account authorization and subsequent Change Order and (c) the Authorization to commence Work. As the authorized Work progresses, the Contractor must maintain accounting of actual costs incurred in accomplishing the Work. The accounting must include an annotated copy of the Overall Project Schedule to accurately show the status of the Work.

3.2.7.3.2 Actual costs, except as otherwise agreed to in writing by the Owner, shall not exceed those prevailing for the trades or crafts, materials, and equipment in the locality of the Project, shall include only those items listed as allowable in Section 3.2.9, and shall not include any of the costs listed as not allowable in Section 3.2.10. The Owner shall be permitted, on a daily basis, to verify such records and may require such additional records as are necessary to determine the cost of the change to the Work.

3.2.7.3.3 The Stipulated Maximum Sum shall be based on the estimated cost of the Work and the Contractor's allowance for overhead and profit as set forth in Section 3.2.8 below, including any time extension and a reasonable contingency. It shall be the sole responsibility of the Contractor to apply in writing to the Owner, NOT to the Design Professional, for an increase in the Stipulated Maximum Sum if the total value of the Work is approaching and might exceed the Stipulated Maximum Sum

3.2.7.3.4 Within fourteen days of the conclusion of such Work ordered by Force Account, the Contractor and the Owner shall arrive at the total lump sum cost for the confirming Change Order. Such lump sum cost shall be incorporated into and finalize the Change Order, and shall reference and close the Incumbrance Record establishing the Force Account.

3.2.7.3.5 In-part Change Order. If the Work performed under a Force Account Authorization extends beyond monthly Applications for Payment, the Contractor may request interim payment for Work performed. In such case, the Owner will issue an in-part lump sum Change Order as described in this Section. A lump sum Change Order must be executed before, including Force Account Work on an Application for Payment.

3.2.7.4 Breakdown of Expenditures. The Contractor shall review any Owner requested or directed change and shall respond in writing within fourteen calendar days after receipt of the proposed change (or such other reasonable time as the Owner may direct), stating the effect of the proposed change upon his Work, including any increase or decrease in the Contract Time and Sum. The Contractor shall furnish to the Owner and the Design Professional an itemized breakdown of the quantities and prices and expenditures for labor and materials used in computing the proposed change in Contract Sum, in a format acceptable by the Owner, which shall contain the following elements:

(a) Restatement of the scope of work of the proposed Change Order.
(b) Itemized breakdown of items, quantities, unit costs and total costs; application of overhead and profit amounts, and grand total.
(c) Statement of the Contractor in the following exact language:

"I do solemnly swear to the best of my knowledge, information, and belief, that the costs shown hereinabove do not exceed current costs for like services or materials in the locality of the Project and, in the case of a Force Account, the costs represented do not exceed the actual costs to the Contractor; and that the quantities shown do not exceed actual requirements."

(d) Signature and title of the person submitting the breakdown of expenditures for the Contractor.

(e) Signature and date of the Contract Compliance Specialist certifying to the following statement to be inserted below the signature of the CM/CG in the following exact language:

"CERTIFICATION OF CONTRACT COMPLIANCE SPECIALIST
I have checked the quantities in the above breakdown of expenditures and certify that they are, to the best of my knowledge and belief, reasonable and accurate."

The Contractor shall obtain and furnish as back up to the Contractor's breakdown a separate breakdown for each subcontractor's charges prepared by each subcontractor on the letterhead of the subcontractor and properly signed by the subcontractor. The Owner shall review the Contractor's proposal and respond to the Contractor within fourteen days of receipt.

3.2.8 Overhead and Profit

3.2.8.1 Overhead and Profit. Subject to the limitations described herein, the percentage for overhead and profit to be used in calculating the Change Order Sum (*See* Section 3.2.7.2 regarding unit prices) shall not exceed the percentages for each category listed below. Said percentages for overhead and profit shall be applied only on the net cost of the changed Work, (i.e., the difference in cost between original and revised Work).

3.2.8.1.1 Work Performed Directly by Contractor. If the Contractor does all or part of the changed Work with employees that work directly for the Contractor, his markup for overhead and profit on such changed Work shall not exceed twenty (20%) of the of the net Allowable Costs, if any. Contractor shall not be allowed any additional markup including but not limited to the markup contemplated in Section 3.2.8.1.2 below.

3.2.8.1.2 Work Performed by Subcontractor(s). If a Subcontractor does all or part of the changed Work with employees that work directly for the Subcontractor, the Subcontractor's markup for overhead and profit shall not exceed twenty percent (20%) of his net Allowable Costs. Under this contract, the forces of a subcontractor of a subcontractor are deemed to be and are the forces of the subcontractor and the total management markup for overhead and profit for all tiers of subcontractors shall not exceed in the aggregate twenty (20%) of the net Allowable Costs of the subcontractor who performs the work. The Contractor's allowable management markup for overhead and profit shall not exceed a total of seven and one half percent (7.5%) of the amount due to the Subcontractor (including Subcontractor's overhead and profit).

3.2.8.2 The above percentages shall be applied to the net Allowable Costs, if any, as limited and defined in this Part. If the net difference between Allowable Costs and credits to the Owner results in a decrease in the Owner's cost, the amount of credit allowed the Owner shall be the net decrease without any allowance for overhead and profit. All costs that are not Allowable Costs in Section 3.2.9 or are disallowed in Section 3.2.10 shall be considered as overhead and shall be exclusively compensated in the allowances provided for in Section 3.2.8.1 above.

3.2.9 Allowable Costs for Changes in the Work. Allowable cost for changes to the Work are limited to the following:

3.2.9.1 Labor costs for employees directly employed in the change in the Work, including salaries and wages plus the cost of payroll charges and fringe benefits and overtime premiums, if such premiums are explicitly authorized by the Owner.

3.2.9.2 Materials incorporated into the change to the Work, including costs of transportation, handling, fuel, and on-site storage, if applicable.

3.2.9.3 Equipment incorporated in the changed Work or equipment used directly in accomplishing the Work. If the equipment is rented expressly for accomplishing the change in the Work, that cost shall be the rental rate according to the terms of the rental agreement, which the Owner shall have the right to approve, or shall be set at rates established in the manner set forth in Section 2.1.7. The decision of the Owner shall be final, binding, and conclusive on all parties.

3.2.9.4 Costs of increases in premiums for the Contractor's Payment Bond and Performance Bond, or other bonds required by the Owner, provided coverage for the cost of the change in the Work results in such increased costs. Prior to requesting payment for the Change Order work, the Contractor shall provide proof of its notification to the Surety of the change in the Work and of the Surety's agreement to include such change in its coverage. The cost of the increase in premium shall be an allowable cost but shall not be marked up for overhead and profit. In no event shall an increase in premiums for the Contractor's Payment Bond and Performance Bond in excess of two percent of the cost of the change be allowable.

3.2.9.5 Sales, consumer, use, and other applicable taxes that are legally in effect at the time the change order is approved. The cost of the taxes shall be an allowable cost but shall not be marked up for overhead and profit.

3.2.9.6 Any other costs directly attributable to the change in the Work, and approved by the Owner such as professional engineering costs, except those set forth in Sections 3.2.10.

3.2.9.7 For Change Order Work directed by the Owner, where the headquarters of the Subcontractor actually performing the work is more than 100 miles from the Project Site, the Subcontractor may include in the cost of the Change Order a stipend of fifty dollars per day for each worker performing work at the Site if that worker is receiving a per diem under present company policy, not to exceed the number of workers and number of days determined by Design Professional's decision to be attributable to the new work so ordered, so long as the number of workers and number of days attributable to any deleted work is deducted there from. No allowance for overhead or profit as set forth in Section 3.4.8 may be added to the Change Order cost on account of the stipend amount, and the full amount of the stipend must be actually paid to the eligible worker or it shall be forfeited by the Contractor and Subcontractor(s).

3.2.9.8 The Owner may require any or all of the following documentation to be provided by the Contractor to support the Allowable Costs:

(a) Certified payroll records showing the name, classification, date, daily hours, total hours, rate, and extension for each laborer, foreman, supervisor or other worker;
(b) Equipment type & model, dates, daily hours, total hours, rental rate or other specified rate, and extension for each unit of equipment;
(c) Invoices for materials showing quantities, prices, and extensions;
(d) Daily records of waste materials removed from the Site and/or fill materials imported to the Site;
(e) Certified measurements of over excavations, piling installed and similar work; and/or
(f) Transportation records for materials, including prices, loads, and extensions.

3.2.10 Costs Not Allowable for Changes in the Work. Costs not allowable under any circumstances are as follows:

3.2.10.1 Costs due to the negligence of the Contractor, Subcontractors, Suppliers or other persons for whom the Contractor is responsible, including but not limited to costs of delay, costs for the correction of Non-Compliant Work, costs for improper disposal of material, costs for equipment wrongly supplied, costs for the Contractor's delay in performing the Work, or costs for delay in ordering and obtaining normally available materials or equipment.

3.2.10.2 Home office expenses, including payroll costs for the Contractor's or any Subcontractors' or Suppliers officers, executives, administrators, accountants, counsel, engineers, timekeepers, estimators, clerks, and other similar administrative personnel employed by the Contractor, whether at the Site or in the Contractor's or a Subcontractor's principal or branch office for general administration of the Work (including those referred to as "Eichlay costs"). These costs are deemed overhead included in the percentage markups allowable in Section 3.2.8 above.

3.2.10.3 Home and branch office expenses that include, but are not limited to, expenses of Contractor's home and branch offices, Contractor's capital expenses, interest on Contractor's capital used for the Work, charges for delinquent payments, small tools, incidental costs, rent, utilities, telephone and office equipment, and other general overhead expenses of the home and branch office (including those referred to as "Eichlay costs").

3.2.10.4 Where Work is deleted from the Contract (by Bulletin, Change Order, or otherwise) prior to commencement of that Work without substitution of other similar Work, one hundred percent of the Contract Sum attributable to that Work shall be deducted from the Contract Sum. However, in the event that material submittals have been approved and orders placed for said materials, a lesser amount as justified by proper documentation shall be deducted from the Contract Sum. The credit if any to the Owner for reduced premiums on payment bonds and performance bonds shall be in all cases one hundred percent of the credit. If the deductive Change Order affects the critical path or the schedule and it causes an overall reduction in the Contract Time, jobsite time dependent expenses shall be included in the deduction at a mutually agreeable amount or rate.

3.2.10.5 Wages of a foreman, if the foreman is concurrently supervising other Work at the Site.

3.2.11 Change Order Formats. Formats for Change Orders and for authorization to commence work under force account are in Section 7, Forms. All Change Orders are issued by the Owner.

3.2.12 Changes due to Subsurface or Other Unforeseen Conditions.

3.2.12.1 Subsurface Conditions. Unless the Contract Documents stipulate specific quantities and units of rock or unsuitable soils, the Contractor shall assume material below the surface of the Earth to be earth and other material that can be removed by power shovel or similar equipment. Should conditions encountered below the surface of the ground be at variance to the number of unit requirements as indicated by the Contract Documents, and absent an agreed-upon unit price established prior to the bid, or after contract execution by Change Order, the Contract Sum and/or time shall be adjusted as provided in the Contract Documents for changes in the work.

3.2.12.2 Other Unforeseen Conditions. If unknown physical conditions are encountered at the Site that differ materially from those indicated in the Contract Documents, then the Contractor shall give notice to the Design Professional promptly before conditions are further disturbed, but in no event later than two business days after the first observance of the conditions. The Design Professional shall promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost or time required for performance of any part of the Work, the Design Professional may recommend an adjustment by Change Order to the Contract Sum or Contract Time, or both. If the Design Professional determines that the conditions at the Site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Design Professional shall so notify the Owner and the Contractor in writing, stating the reasons. Protest by either party of the Design Professional's decision shall be in accordance with Section 5, Part 2.

3.2.13 Compensable Rock. CAUTION: No rock for which extra compensation is expected to be received shall be removed except pursuant to and in conformity with a written authorization or order of the Owner. Unless otherwise provided in the Bid Documents, no removal of rock as defined herein shall be included in the Bid. Shale, rottenstone, or stratified rock that can be loosened with a pick or removed by a hydraulic excavator equivalent to a Caterpillar Model 215, a single engine pan (Caterpillar 621 or equivalent) that is pushed by a crawler tractor (Caterpillar D-8K or equivalent), or similar equipment shall not be classified as rock.

3.2.13.1 Definitions of Compensable Rock. Rock, for the purposes of pricing its removal, is defined as follows:

3.2.13.1.1 Rippable Rock. Rippable rock is defined as any material that can be ripped with a single-tooth hydraulic ripper drawn by a crawler tractor having a minimum draw bar pull rated at not less than 56,000 pounds (Caterpillar D-8K or equivalent) and occupies an original volume of at least one cubic yard.

3.2.13.1.2 Mass Rock. Mass rock is defined as any material that cannot be ripped with a single-tooth hydraulic ripper drawn by a crawler tractor having a minimum draw bar pull rated at not less than 56,000 pounds (Caterpillar D-8K or equivalent) and occupies an original volume of at least one cubic yard.

3.2.13.1.3 Trench Rock. Trench rock is defined as any material that must be removed from a trench that cannot be excavated with a hydraulic excavator having a bucket curling force rated at not less than 18,300 pounds (Caterpillar Model 215 or equivalent) and occupies an original volume of at least one-half cubic yard.

3.2.13.1.4 Caisson Rock. Caisson Rock is defined as material that must be removed from a shaft which cannot be penetrated faster than two feet per hour (fifteen minute minimum) using a rock auger with bullet-shaped hardened steel teeth (Kennametal bits or equivalent), and the drilling equipment should have the capacity to produce a continuous torque of at least 1,000,000 inch pounds and a downward force of at least 50,000 pounds (a Hughes LLDH in good working condition) for piers up to seventy two inches in diameter. Use of equipment with greater torque or downward force modifies the definition of refusal to be the point at which the equipment cannot penetrate faster than two feet per hour (fifteen minute minimum). In rare cases, refusal may occur on a rock seam or boulder above the general massive rock surface. The compensation for Caisson Rock should include only material that cannot be penetrated by the rock auger at the specified rate.

3.2.13.2 Pricing for Compensable Rock. All compensable rock shall be priced by unit prices based upon estimated volume prior to removal calculated by survey and engineering calculations. No rock shall be priced by truckload, bucket load, or other similar pricing methods. Unit prices shall be determined prior to removal, either in the Contract Documents or by Change Order. Unit prices shall be inclusive of all profit and overhead. Unit prices shall include the following:

(a) Excavation and removal of all rubble;
(b) Addition and removal of overburden for blasting;
(c) Excavation of all blast rubble;
(d) All costs of labor, equipment, supplies, blasting materials, safety requirements, drayage, haulage, and disposal, including offsite disposal costs.

3.2.14 Release of Claims. The execution by the Contractor of a Change Order shall be and operate as a release to the Owner of all claims by the Contractor and of all liability owing to the Contractor for all things done or furnished in connection with the Work described in the Change Order. The execution of any Change Order by the Owner shall not be an acceptance of any Work or materials not in accordance with the Contract Documents, nor shall it relieve the Contractor of responsibility for faulty materials or workmanship or operate to release the Contractor or his surety from any obligation arising under the Contract or the Performance Bond or Payment Bond.

3.2.15 Sole Source Designation for Change Order Work.

3.2.15.1 Definition of Sole Source. As used in this Section,"Sole Source" means a Subcontractor or Supplier specified by name in a Bulletin as the exclusive source from which conforming goods or services must be obtained. Designation of goods or services by reference to a named source accompanied by the qualification "or equal" or similar language is not a designation of a Sole Source as that term is defined herein.

3.2.15.2 Limitations. This Section applies only to Bulletins referenced in a proposed Change Order that designates a Sole Source that was not designated in the Bidding Documents. Except as stated in this Section, the Contractor's inability to obtain payment and performance bonds from Sole Source Subcontractors or warranties from Subcontractors, as required under the Bidding Documents for this Contract, shall not otherwise excuse the Contractor from its bonding and warranty obligations under this Contract.

3.2.15.3 Sole Source as Grounds for Rejection of a Change Order. If a Change Order is submitted to Contractor for the purposes of adding a Bulletin to this Contract and said Bulletin designates a Sole Source from which Contractor is required to procure goods or services necessary to perform the Work, which Sole Source has not been designated previously, Contractor shall be entitled to reject the proposed Change Order if the designated Sole Source refuses to provide to Contractor the warranties, bonds, terms or schedule required under the Contract Documents, including any warranty or terms or schedule required by Bulletins referenced in the proposed Change Order. In such event, Contractor shall give written notice to the Owner rejecting the proposed Change Order and, if possible, shall accompany said written notice with a proposal from Contractor for changes or

modifications to the Bulletin so as to eliminate the Sole Source designation but to achieve goods or services equal in quality or function. The Owner may then require the Design Professional to revise the subject Bulletin so as to eliminate the designation of the Sole Source by incorporation of Contractor's proposal or otherwise. Upon revision of the Bulletin by the Design Professional and approval thereof by the Owner, the Owner shall again submit to the Contractor a proposed Change Order for the purpose of adding the revised Bulletin to this Contract. If the Owner decides to retain the Sole Source in the Change Order and Contractor cannot acquire the full contractually required warranties from the Sole Source, Contractor shall be held only to the warranty terms and schedule obtainable from the Sole Source.

3.2.15.4 No Excuse Without Notice. If Contractor accepts a proposed Change Order adding a Bulletin to this Contract that designates a Sole Source without invoking this Section and putting the Owner on notice, Contractor shall not be excused from its obligations with respect to the described Work by reason of the refusal of a designated Sole Source to provide warranties as required under this Contract.

3.2.16 Effect of Change Order. A Change Order takes precedence over any inconsistent terms of the Contract Documents preexistent to the Change Order.

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PART 3 – TIME

3.3.1 Time is of the Essence. Time is of the essence of this Contract and all obligations hereunder.

3.3.2 Competent Management of Time. The Contractor has represented to the Owner, in order to be awarded this contract, that the Contractor is experienced in managing construction in accordance with contract requirements and in a timely manner and that the Contractor has included in his proposal sufficient sums to carefully and competently manage this project for completion by the Material Completion Date.

3.3.3 Contract Time.

3.3.3.1 Fair and Reasonable. The Contractor has carefully examined and analyzed the Site, the Contract Documents, and all known factors related to his ability to complete this project within the Contract Time stipulated. By submitting his bid for this project, the Contractor agrees that the stipulated Contract Time is fair and reasonable.

3.3.3.2 Delays. The parties recognize there may be delays to perform Change Order work in the event that conditions encountered at the Site are different from those indicated in the Contract Documents, or to perform Change Order work to correct errors in the plans and specifications. Execution of any change must be authorized. In such event, there shall be an adjustment in the Contract Sum as provided in the Contract Documents for changes in the Work, The parties agree that such delays are not a ground for claiming extraordinary remunerations except as set forth in this Contract in Section 3.3.8 below.

3.3.4 Commencement, Prosecution, and Completion.

3.3.4.1 Commencement, Prosecution, and Completion of Work. The Contractor shall (a) commence performance of its activities on the Site within five days of the date specified in the Proceed Order. (b) prosecute the work with faithfulness and energy (c) install the various parts of the work with equal steps shown on the Overall Project Schedule and at the same rate (or better) shown on the Overall Project Schedule and (d) complete the work within the Contract Time, as adjusted. Commencement of work shall mean actual physical work on the Site. Unless otherwise agreed, and subject to Change Orders, Material Completion of the Project must be achieved on or before the date established as the Material Completion Date.

3.3.4.2 Contractor's Acceleration for failure to meet Schedule Requirements. In the event the Contractor shall be delinquent in respect to achieving the Milestone dates established in the Overall Project Schedule, Contractor shall, within seven days after receipt of written demand of the Owner, cause its employees and Subcontractors to perform work at an accelerated pace with hours and days in addition to the normal working hours and working days, as necessary to promptly bring the Work into compliance with the Overall Project Schedule. Fulfillment of this requirement as to overtime work shall not relieve the Contractor from liability for breach of the covenant as to time. For account of recovery of lost time required of the Contractor for its breach of covenant as to time, the Contractor shall be entitled to no claim against the Owner for any payment, repayment, reimbursement, remittance, remuneration, compensation, profit, cost, overhead, expense, loss expenditure, allowance, charge, demand, hire, wages, salary, tax, cash, assessment, price, money, bill, statement, dues, recovery, restitution, benefit, recoupment, exaction, injury or damages.

3.3.5 Construction Progress Schedule and Overall Project Schedule. (See Sections 2.1.5 and 3.5.5.4)

3.3.6 Material Completion Date. The Work under this Contract shall achieve Material Completion by 11:59 PM Eastern Prevailing Time of the date required in the Contract as the Material Completion Date unless extended by approved Change Order.

3.3.7 General Rule – No Damages for Delay, Extension of Time Sole Remedy. Extension of time is the Contractor's sole remedy for any delays not the fault of the Contractor. Contractor shall not be entitled to any damages for delay or to any other reimbursement as a Cost of the Work, or to an increase in the Contract Sum, or to payment, damages, monies, or compensation of any kind from Owner for direct, indirect, impact, or disruption damages (including but not limited to costs of acceleration of Work or any Phase thereof) arising because of delay or other hindrance of any kind whatsoever; except as specifically permitted by Section 3.3.8.

3.3.7.1 Extension of Time for Abnormal Weather. Extensions of time will be granted for abnormal weather conditions that delay the critical path of the progress of the work, subject to the conditions subject to the provisions below.

3.3.7.1.1 Weather Delay Days. Weather delay days are those days where the project site receives more than ½" of precipitation or extreme weather conditions and the event causes a delay in the critical path work.

3.3.7.1.2 Anticipated Weather Delay Days. Anticipated weather delay days are the weather delay days specified in the Supplementary General Conditions that the Contractor shall expect to incur and shall provide for in the schedule.

3.3.7.1.3 Abnormal Weather Delay Days. Abnormal weather delay days are weather delay days in excess of the number of days specified in the Supplementary General Requirements.

3.3.7.1.4 Documenting Weather Delay Days. Upon acknowledgment of the Proceed Order and continuing throughout the contract, the Contractor shall record actual weather delay days incurred at the site and describe the weather's impact to the critical path. Weather delay days shall be documented by the Contractor and verified by the GSFIC Contract Compliance Specialist. Not later than ten days after the end of each calendar month, the Contractor shall submit a report to the Design Professional documenting the number of weather delay days incurred in the month and the number of anticipated weather delay days remaining.

3.3.7.1.5 Extensions of Time for Abnormal Weather Delay Days. The Contractor shall be entitled to a contract extension due to weather delay days whenever the number of weather delay days incurred is greater than the total number of anticipated weather delay days for the project, The Design Professional shall determine if each subsequent weather delay day impacts the critical path.

3.3.7.1.6 Claims for Extension of Time for Abnormal Weather Delay Days. When the number of weather delay days incurred exceeds the number of Anticipated Weather Delay Days, the Contractor may make a claim for contract extension. These claims shall be processed as a Change Order pursuant to Section 3, Part 4. The Contractor must make reasonable efforts to mitigate the effects of abnormal weather delay days in order to be entitled to a contract extension or contract adjustment.

3.3.7.1.7 Protest. The Design Professional's recommendations as to abnormal weather delay shall be subject to protest by the Contractor as set forth in Section 5, Part 2.

3.3.8 Exception to General Rule – Compensable Delay. The extension of the Contract Time and the adjustment to the Contract Sum specifically provided for in this Section shall be Contractor's sole and exclusive remedy for delays, hindrances, interferences or resulting inefficiencies and re-sequencing.

3.3.8.1 Compensable Delay – Unavoidable Delay.

3.3.8.1.1 Delay by Owner or Design Professional. If the Contractor is delayed in the progress of the Work by an act or neglect of the Owner, Owner's employees, Design Professional or Separate Contractors employed by the Owner, or by other causes beyond the Contractor's control which the Owner determines are the fault of the Owner or the Design Professional and may justify delay, then the Contract Sum may be adjusted and the Contract Time may be extended by Change Order for such reasonable time as the Owner may determine; provided, however, that (i) such delays extend the Overall Project Schedule's critical path; (ii) the Contractor has taken all reasonable actions to mitigate the effects of the delay on the Work; (iii) the fault or negligence of the Contractor, the Contractor's agents or employees did not materially contribute to such causes; and (iv) the Contractor shall have notified Owner of the cause or causes of such delay within fourteen days from the date on which the Contractor first becomes aware of such delay. Extension of time and compensation for compensable delay are to be processed as a Change Order pursuant to Sections 3.2.6 and 3.2.7.

3.3.8.1.2 Delay in Responses to Submittals. Any claim by Contractor for a change in the Material Completion Date due to delay of responses to submittals that materially affect the completion of the Work by lengthening the critical path of the Construction Progress Schedule may be made during the time while the failure of the Design Professional to act or perform continues, or within seven days after such failure to act or perform has been cured. If no Submittal Schedule or agreement as required in Section 2.2.3 is agreed upon, then a claim for delay will be allowed only after the Design Professional has been allowed fourteen days to take action. Any claim for extension of time or adjustment of Contract Sum must be reasonable and take into consideration the nature of the submittal.

3.3.8.1.3 To be Processed as a Part of the Change Order Process. Extensions of Time and adjustments to the Contract Sum for compensable Unavoidable Delay are to be processed as a Change Order pursuant to Section 3, Part 2.

3.3.8.2 Compensable Delay – Certain Change Orders.

3.3.8.2.1 Owner-Requested Changes. If the Owner requests changes in the Contract Documents that would materially affect the completion of the Work by lengthening the critical path of the Overall Project Schedule, the Design Professional shall recommend the appropriate number of additional days to be considered in the Change Order. Contractor agrees that any monetary remedy associated with such extensions of time shall be no greater than the actual direct costs incurred by the Contractor.

3.3.8.2.2 Other Change Orders. For Change Orders involving the following situations that would materially affect the completion of the Work by lengthening the critical path of the Construction Progress Schedule, the Design Professional shall recommend the appropriate number of additional days to be considered in the Change Order. Contractor agrees that any monetary remedy associated with such extensions of time shall be no greater than the actual direct costs incurred by the Contractor.

(a) Changes due to Subsurface or Other Unforeseen Conditions, Section 3.2.12.
(b) Changes for Compensable Rock, Section 3.2.13.
(c) Changes deleting work, Section 3.2.10.4

3.3.8.2.3 To be Processed as a Part of the Change Order Process. Extensions of Time and adjustments to the Contract Sum for any of the compensable change order delays set forth in this Section 3.3.8.2 are to be processed as a part of each Change Order pursuant to Section 3, Part 2.

3.3.8.3 Compensable Delay – *Force Majeure*. If, between the Proceed Order Date and the Material Completion Date, as amended, the Contractor is unable to perform or is delayed in the performance of any of the terms and provisions of this Contract, that materially affects the completion of the Work by lengthening the critical path of the Construction Progress Schedule, as a result of (i) governmental preemption of materials in connection with a national emergency declared by the President of the United States; (ii) riot, insurrection, acts of terror or terrorism or other civil disorder affecting performance of the Work; (iii) labor strikes that could not be reasonably anticipated by the Contractor, or (iv) earthquakes, or unusual and extreme weather conditions constituting Acts of God, then, and in any such event, such inability or delay shall be excused, and the time for completing the affected portions of the Project (and the entire Project, if applicable) shall be extended for such reasonable period of time as the delay has affected the critical path of the performance of the Work hereunder.

3.3.8.3.1 Mitigation of Delay. Contractor shall take all reasonable actions to minimize the delay caused by any of the above factors, and shall notify Owner in writing with a copy to the Design Professional of any event allowing for excuse or delay not later than seven days after the Contractor first becomes aware of the event, or should have become aware, of the event; otherwise Contractor will be deemed to have waived the excuse or delay.

3.3.8.3.2 To be Processed as a Part of the Change Order Process. Extensions of Time and adjustments to the Contract Sum for *Force Majeure* are to be processed as a Change Order pursuant to Section 3, Part 4.

3.3.9 Non-Compensable Delay. Contractor understands, acknowledges and agrees that delays occasioned by the events and occurrences set forth below are not compensable delays and do not constitute reason for extending the Date for Material Completion. It is Contractor's responsibility to make adequate provision for the following in scheduling the Work:

3.3.9.1 Normal Weather Conditions. Weather conditions other than those that substantially vary from the normal climatology conditions that prevailed at the Site for the preceding 120 months, as evidenced by data published by the National Oceanic and Atmospheric Administration.

3.3.9.2 Delay in Delivery of Materials or Equipment. Delay in delivery of materials or equipment for any cause other than those specified in Section 3.3.8.3. No claim will be approved if materials or equipment are delayed due to Contractor's tardy procurement or expediting.

3.3.9.3 All Other Delay. All delay not covered in Section 3.3.8.

3.3.10 Submission of Claims for Compensation for Delay and to Extend the Material Completion Date.

3.3.10.1 Time for Submission. Except as specified below, any claim by Contractor for a change in the Contract Sum or the Material Completion Date shall be made within fourteen days of the day on which the Contractor becomes aware of the event on which the claim is based or, if the Contract Documents specify a shorter or longer period with respect to such event, within the period specified by the Contract Documents.

3.3.10.2 Delay Claim Must Be In Writing. Any claim to extend the Contract Sum or Material Completion Date must be in writing, must set forth in detail the basis for the claim and the number of days of delay claimed, must be correlated with the approved Overall Project Schedule, must be executed by the Contractor and delivered to the Design Professional and the Owner, and must be reviewed and an appropriate time assessed by the Design Professional.

3.3.10.3 When Delay Claim Deemed Waived. Any claim to extend the Contract Sum or Material Completion Date not made in writing to Owner within the above time periods shall be deemed waived and shall not thereafter be valid. In the case of a continuing delay as a result of a single event, only one claim submission is necessary.

3.3.11 Recovery of Schedule Delays.

3.3.11.1 Recovery of Schedule Delays. If the Design Professional determines that the Project is one week or more behind schedule, per the approved Overall Project Schedule, the Design Professional shall so notify the Contractor in writing. Within seven days of the date of the Design Professional's notice, the Contractor shall deliver to the Design Professional and Owner a written plan explaining how the Contractor intends to bring the Project back on schedule. The Contractor's plan must provide sufficient detail to allow the Design Professional and Owner to determine the proposal's feasibility.

3.3.11.2 Recovery of Schedule Delays During Last Sixty Days of Contract Time. At any time during the last sixty days of the Contract Time that the Design Professional or Owner finds that the Contractor is behind schedule per the Contract Time, as amended, the Design Professional or Owner shall notify the Contractor in writing. Within seven days of the date of such notice, the Contractor shall prepare and deliver to the Design Professional and Owner a written plan explaining how the Contractor intends to bring the Project back on schedule. The Contractor's plan must provide sufficient detail to allow the Design Professional and Owner to determine the proposal's feasibility.

PART 4 – CORRECTING THE WORK, INSPECTIONS, COVERING AND UNCOVERING WORK

3.4.1 Duty to Promptly Correct Work. The Contractor shall promptly correct Work rejected by the Design Professional or Owner or known by the Contractor to be defective, damaged, or failing to conform to the requirements of the Contract Documents, whether observed before or after Material Completion and whether or not designed, fabricated, installed, or completed. The Contractor shall bear costs of correcting such rejected Work, including without limitation additional testing and inspections.

3.4.1.1 Full and Complete Charge. Notwithstanding the provisions of this Contract, and until Material Completion, the Contractor shall have full and complete charge and care of the Work or any portion thereof (including the Owner-furnished supplies, material, equipment, or other items to be utilized or incorporated in the Work). After Material Completion is achieved, the Contractor shall remain in complete charge and care of the items remaining to be completed on the initial Punchlist and Permitted Incomplete Items until all are accepted by the Owner on or before Final Completion.

3.4.1.2 Make Good Losses. The Contractor shall rebuild, repair, restore, and make good losses of, and injuries or damages to, the Work or any portion thereof (including the Owner-furnished supplies, material, equipment, or other items to be utilized with, or incorporated in, the Work and that are at the Site) before Material Completion of the Work. Such rebuilding, repair, or restoration may be paid from the Construction Contingency; provided, however, that the Owner will make available applicable proceeds from the Builders' Risk policy required by the Contract Documents.

3.4.1.3 No Limitation. Nothing contained in this Part shall be construed to establish a period of limitation with respect to the Contractor's obligations to correct defective or non-conforming Work under this Contract, at law or in equity.

3.4.2 Correcting the Work.

3.4.2.1 Notice of Non-Compliant Work. A Notice of Non-Compliant Work shall be in writing, shall be dated, shall be signed by the Design Professional, shall be addressed to the Contractor with a copy to the Owner, and shall contain three elements as follows:

3.4.2.1.1 Description of Work.

(a) that has been omitted or
(b) that is unexecuted as of the date of the Notice of Non-Compliant Work, the time for its incorporation into the work as planned in the Overall Project Schedule having expired, or
(c) that has not been executed in accordance with the methods and materials designated in the Contract Documents.

3.4.2.1.2 Contract References: Citation of the provision or provisions of the Contract Documents which specify the Work to be executed.

3.4.2.1.3 Time for Compliance. Fixing of a reasonable space of time within which the Contractor shall have made good the deficiency (which said space of time shall not be deemed to be an extension of Contract Time) for filing the Notice of Readiness for Inspection for Material Completion pursuant to Section 6.3.2 nor shall it be deemed to be authorization for amendment to the Overall Project Schedule.

3.4.2.2 Failure to Supply Workmen or Materials or to Prosecute the Work. A Notice of Non-Compliant Work may be issued for failure of the Contractor to supply enough workers or enough materials or proper materials to prosecute the Work. A Notice of Non-Compliant Work in such event may be based on Section 3.3.2 (Competent Management of Time), and upon the definition of Work as set forth under Paragraph 1.1.9.57.

3.4.2.3 Removal and Making Good of Non-Compliant Work. The Contractor shall remove from the Site within the space of time designated in Notice of Non-Compliant Work all work determined by the Design Professional as failing to conform to the contract, whether incorporated in the work or not, and

the Contractor shall promptly replace and re-execute the work in accordance with the Contract and without expense to the Owner and shall bear the expense of making good all work of other contractors destroyed by such removal or replacement. The Contractor shall supply any omitted work and perform all unexecuted work within the space of time fixed by the Design Professional in Notices of Non-Compliant Work.

3.4.2.4 Remedy of the Owner for Breach of Notice of Non-Compliant Work.

3.4.2.4.1 Failure to Make Good a Deficiency. If the Contractor does not make good a deficiency within a reasonable space of time fixed in a Notice of Non-Compliant Work, the Owner may do any of the following:

(a) Remove the Non-Compliant Work and store it at the expense of the Contractor. If the Contractor does not pay the expenses of such removal and storing within ten days after receipt of written demand of the Owner, the Owner may upon three days' notice in writing to the Contractor sell such materials at private sale or at auction and shall account for the net proceeds thereof after deducting all proper costs incurred by the Owner.

(b) Supply omitted work, perform unexecuted work, or replace and re-execute work not done in accordance with the methods and materials designated in the Contract Documents, and deduct the cost thereof from any payment then or thereafter due the Contractor.

3.4.2.4.2 Other Remedies. The remedies stated in this Section are in addition to the remedies otherwise available to the Owner, do not exclude such other remedies, and are without prejudice to any other remedies. Time limits stated in Notices of Non-Compliant Work are of the essence of the contract. Unless otherwise agreed to by the Owner in writing, the making good of Non-Compliant work shall physically commence at the Site in not more than seven days after receipt of the Notice of Non-Compliant Work, except that in case of emergency correction shall physically commence at the Site at once, and except that the Contractor shall in any event physically commence the correction at the Site early enough to complete within the space of time allowed in the Notice of Non-Compliant Work. The Owner shall give prompt consideration to reasonable requests for delay in commencement of the making good of Notices of Non-Compliant Work. The making good of Non-Compliant work shall be completed within the space of time allowed in the Notice of Non-Compliant Work unless the Contractor shall have requested from the Design Professional an increase in the amount of time allowed and the Design Professional shall have given notice to the Contractor in writing, with copy to the Owner, stating the additional amount of time, if any, allowed.

3.4.2.5 Notice of Correction from Contractor. The Contractor shall give prompt notice in writing to the Design Professional, with copy to the Owner, upon completion of the correction of the Non-Compliant work. In the absence of such notice, it shall be and is presumed under this Contract that there has been no correction, supplying remedy, or performance of unexecuted work.

3.4.2.6 The Owner's Right to Correct Work. If the Contractor should neglect to prosecute the Work properly or fail to correct Non-Compliant Work or fail to perform any provision of this Contract, the Owner, after three days' written notice to the Contractor, may without prejudice to any other remedy he may have (including without limitation remedies against the Contractor's surety), make good the deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor.

3.4.3 No Delay. Work requiring correction shall be corrected immediately and shall be carried out in such a way not to delay the completion of the Project. If it is not feasible to correct said work immediately, the corrective work shall be done on a schedule acceptable to the Owner.

3.4.4 Effect of Notice of Non-Compliant Work. Notwithstanding anything contained in the Contract Documents to the contrary, in order to minimize delays in the completion of the Project, the Contractor shall continue working while responding to a Notice of Non-Compliant Work and shall continue working while protesting any decision by the Design Professional or the Owner.

3.4.5 Deductions for Uncorrected Work. If the Design Professional and Owner deem it inexpedient to correct work injured or done not in accordance with the contract, an equitable deduction from the contract price shall be made therefore and confirmed by execution of a lump sum Change Order. There is no duty on the part of the Owner, however, to accept any work injured or done not in accordance with the methods and materials designated in the contract documents, nor does the Contractor have the right to demand that there shall be acceptance of work injured or done not in accordance with the methods and materials designated in the Contract Documents.

3.4.6 Inspections.

3.4.6.1 Access to Work. The Design Professional, the Owner, and their representatives shall have access at all times to the work wherever it is in preparation or progress, and the Contractor shall provide proper facilities for such access and for inspection.

3.4.6.2 Notice of Readiness for Inspection to Design Professional from Contractor Prior to Covering Work. If the specifications, the Design Professional's instructions (either in the specifications or issued later in writing), laws, ordinances or any public authority require any work to be specially tested or approved, the Contractor shall give the Design Professional timely notice in writing of its readiness for inspection. If the inspection is by any authority other than the Design Professional, the Contractor shall give timely notice of the date fixed for such inspection. Inspections by the Design Professional shall be made promptly and, where practicable, at the source of supply.

3.4.6.3 Fire Marshal Inspections.

3.4.6.3.1 General. The State Fire Marshal may make inspections at any time. It shall be the responsibility of the Contractor to request an inspection at 80% completion and at 100% completion and to give notice when all items on the 100% inspection report have been completed. Requests shall be in writing with a copy to the Owner and Design Professional.

3.4.6.3.2 Inspections Defined. The basic definitions for 80% and 100% inspections are as follows:

(a) Eighty Percent (80%) Inspection: The structural components are in place and open for review of the fire safety components. NOTE: Structural components include the following: fire walls, vertical shafts, stairways, smoke stops, hazardous area separation, roof and ceiling assemblies, corridor and door width, and HVAC system.

(b) One Hundred Percent (100%) Inspection: The Contractor has completed all of the items on the 80% inspection report and has the certificate of occupancy in hand.

3.4.6.4 False Start. In the event the Contractor shall have issued notice of readiness prematurely, his action shall be deemed to be a "false start." The Contractor shall be liable for the damage resulting from the aforesaid false start, including, but not limited to, the salary, professional fees, and travel and living expenses of the person or parties inconvenienced by the aforesaid false start.

3.4.6.5 Certificate of Occupancy. The Contractor's obligation under the Contract is to install the Work in accordance with the Contract Documents, obtain the Certificate of Occupancy from the State Fire Marshal or his deputy, and forward it to the Design Professional as a part of the final close out procedures. The Design Professional's obligation is to design the Work to comply with the applicable codes and to qualify for a Certificate of Occupancy.

3.4.7 Covering and Uncovering Work.

3.4.7.1 Re-examination or Re-testing of Work Covered Pursuant to Consent of Design Professional. Re-examination or re-testing of questioned Work previously covered pursuant to consent of the Design Professional may be ordered by the Design Professional. If so ordered the Work must be uncovered by the Contractor. The Owner shall pay the cost of re-examination and replacement or of re-testing if such Work is found in accordance with the Contract Documents. The Contractor shall pay

such cost if such Work is found not in accordance with the Contract Documents unless the Contractor can show that a Separate Contractor caused the defect in the Work. In that event, the Owner shall pay such cost. Re-examination or re-testing under the terms of this Paragraph applies only to Work that has been covered with consent of the Design Professional. Work covered without consent of the Design Professional must be uncovered for examination as provided below.

3.4.7.2 Re-examination or Re-testing of Work Covered Without Consent of Design Professional. If any Work should be covered without approval or consent of the Design Professional or contrary to any provision of the Contract Documents, such Work must be uncovered for examination by the Design Professional at the Contractor's expense. The Contractor shall be liable for the costs resulting from the aforesaid uncovering, including, but not limited to, the salary, professional fees, and travel and living expenses of the person or parties inconvenienced thereby.

3.4.8 Inspection Does Not Relieve Contractor. Under the Contract Documents, the Contractor acknowledges that it has the responsibility for furnishing all services, labor, supplies, and materials for the entire Work in accordance with such documents. No provisions of this Section nor any inspection of the Work by the Owner, representatives of the Owner, the Using Agency, Contract Compliance Specialist, engineers employed by the Design Professional, representatives of the Design Professional, or the Design Professional shall in any way diminish, relieve, or alter said responsibility and undertaking of the Contractor. Neither shall the omission of any of the foregoing to discover or to bring to the attention of the Contractor the existence of any Work or materials injured or done not in accordance with said Contract Documents in any way diminish, relieve, or alter such obligation of the Contractor nor shall the aforesaid omission diminish or alter the rights or remedies of the Owner as set forth in the Contract Documents. The Contract Compliance Specialist owes no duty to the Contractor.

3.4.9 Owner May Require Uncovering of Work. The Owner may require any Work to be uncovered, whether or not prior information was provided as to the schedule for covering. Should work so uncovered prove to be in noncompliance with the Contract Documents or the Construction Documents, the cost of uncovering, correction of the Work, recovering, and any schedule recovery costs shall be borne by the Contractor and may be paid from the Construction Contingency. However, if the Contractor complies with the notice requirements above, and the Owner fails to make its desired inspections, and the Owner then requires the Contractor to uncover the Work, the Owner shall bear all additional costs of uncovering and recovering the Work unless the Work is found to be non-compliant with the Construction Documents, in which case the Contractor shall bear all such uncovering and recovering costs, which may be paid from the Construction Contingency. Should the work be compliant, however, the Owner will pay for the uncovering and repair of the affected work, in addition to any delay that affects the critical path of the Project.

3.4.10 Owner May Pay for Uncovering Work. Should the Owner require work to be uncovered contrary to the Contract Documents and the Construction Documents, the Owner shall compensate the CONTRACTOR for any extra cost caused the CONTRACTOR, including any cost of schedule recovery.

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PART 5 – SUBCONTRACTORS AND SUPPLIERS,

3.5.1 Subcontractors and Suppliers.

3.5.1.1 Submission of List. Within fourteen days of the Effective Date of the Contract, the Contractor shall submit in writing to the Design Professional a list of the names of Subcontractors that the Contractor intends to employ on the Work. The list of Subcontractors is not submitted for approval but is for the purpose of establishing the following:

3.5.1.1.1 What trades and portions of the work are to be performed under subcontract, and.

3.5.1.1.2 The names of the parties selected by the Contractor to perform work by subcontract, the aforesaid selection being a matter lying solely within the discretion of the Contractor.

3.5.1.1.3 The Contractor shall identify each minority owned and each female owned Subcontractor or Supplier performing work on or supplying material to the project.

3.5.1.1.4 By not later than the tenth day of the month following the end of each quarter the Contractor shall submit to the owner a list of all minority and female owned Subcontractors, or Supplier performing work on or supplying material to the Project and the amount paid to each for that quarter.

3.5.1.2 No Approval of Subcontractors and Suppliers. Neither the Owner nor the Design Professional undertakes to pass upon or approve any Subcontractor or Supplier.

3.5.2 Representation of Contractor. The Contractor represents that the Subcontractors and Suppliers selected by it are reputable, skilled, reliable, competent, qualified in the trade or field in which they are to perform on the Project, and thoroughly familiar with the codes and laws applicable to their work.

3.5.3 Contractor Responsible for Acts and Omissions. The Contractor agrees that he is as fully responsible for the acts and omissions of his Subcontractors, Suppliers, and employees, and further of all persons directly or indirectly employed by them, as the Contractor is for the acts and omissions of employees and persons directly employed by the Contractor. The failure of a Subcontractor, Supplier, or employee to perform shall not be asserted by the Contractor as an excuse for any omission from or noncompliance with requirements of the Contract Documents; nor shall the Contractor be entitled to an extension of time solely because of failure of a Subcontractor, Supplier, or employee to perform. The subcontracting of work does not relieve the Contractor of the responsibility for the execution of the work and for compliance with all requirements of the Contract Documents. The Contractor shall not assert negligence, inefficiency, insolvency, bankruptcy, or incompetence of any Subcontractor, Supplier, or employee as excuse for the existence of any noncompliance with or omission to fulfill any obligation under the Contract either as to timely performance or as to compliance with methods and materials designated in the Contract Documents; nor shall the Contractor assert nonperformance of a Subcontractor, Supplier, or employee as excuse for the existence of any noncompliance with or omission to fulfill any obligation under the Contract. As to Subcontractor, Supplier, and employees of the Contractor, the doctrine that a principal is liable for the acts and omissions of his agent shall be binding on the Contractor in his relationship to the Owner, and the Contractor may not reverse the aforesaid doctrine by contract or legal mechanism.

3.5.4 No Contract between Owner and Any Subcontractor, Supplier, or Employee. Nothing contained in the Contract Documents shall create any contractual relation between the Owner and any Subcontractor, Supplier, or employee of the Contractor or its Subcontractors.

3.5.5 Relationship of Contractor with Subcontractors, and Suppliers.

3.5.5.1 Obligations of Each. The Contractor agrees to bind every Subcontractor, Supplier (hereinafter collectively referred to as "Subordinate Contractor") to the terms of the Contract Documents insofar as they are applicable to its work, including the following provisions of this Section:

3.5.5.1.1 The Contractor Agrees:

(a) To be bound to the Subordinate Contractor by all the obligations that the Owner owes to the Contractor under the Contract Documents.

(b) To pay the Subordinate Contractor upon the payment of certificates issued under the schedule of values described in the General Requirements the amount allowed to the Contractor on account of the Subordinate Contractor's work to the extent of the Subordinate Contractor's interest therein within seven days of receipt of payment from the Owner; provided, however, that retainage shall be released to the Subordinate Contractor as provided by law and in accordance with the statutory affidavit set forth in Section 7, Forms.

(c) To pay the Subordinate Contractor upon the payment of certificates issued otherwise than the schedule of values such manner that at all times the Subordinate Contractor's total payments shall be as large in proportion to the value of the work done by the Subordinate Contractor as the total amount certified and paid to the Contractor is to the value of the work done by the Subordinate Contractor.

(d) To pay the Subordinate Contractor a just share of any property insurance money received by the Contractor and due to Subordinate Contractor for work performed by Subordinate and paid for by insurance.

(e) That no claim for services rendered or materials supplied or other matters by the Contractor against the Subordinate Contractor shall be valid unless written notice thereof is given by the Contractor to the Subordinate Contractor prior to or during the first ten days of the calendar month following that in which the Contractor determines that the claim is chargeable against that Subordinate Contractor.

(f) To give the Subordinate Contractor, upon its request, an opportunity to be present with Contractor and to submit evidence in any dispute involving rights of the Subordinate Contractor.

3.5.5.1.2 The Contractor Agrees to require its Subcontractors to do the following:

(a) To be bound to the Contractor by the terms of the Contract Documents and to assume toward the Contractor all the obligations and responsibilities that the Contractor by the aforesaid documents assumes toward the Owner.

(b) To submit to the Contractor applications for payment in such reasonable time as to enable the Contractor to apply for payment under these General Requirements.

(c) To make all claims for extras, for extensions of time or for damages to the Contractor in the manner provided in the General Requirements for like claims by the Contractor upon the Owner, except that the time for making such claims to the Contractor is within ten days after the initial event leading to the claim.

(d) To pay their Subordinate Contractors upon the payment of certificates issued under the schedule of values described in the General Requirements the amount allowed on account of such Subordinate Contractor's work to the extent of such Subordinate Contractor's interest therein within seven days of its receipt of payment; provided, however, that retainage shall be released as provided by law and in accordance with the statutory affidavit set forth in Section 7, Forms.

(e) To pay their Subordinate Contractors upon Subcontractor's receipt of payment such that at all times their Subordinate Contractors' aggregate payments shall be in proportion to the Work performed by each of the Subordinate Contractors.

3.5.5.2 Owner Not Obligated to Any Subcontractor, Subordinate Contractor, or Supplier. There is no obligation on the part of the Owner to pay to or to see to the payment of any sums to any Subcontractor, Subordinate Contractor, Supplier, laborer, employee, or person supplying labor, materials, machinery or equipment to the Project.

3.5.5.3 Term "Substantial Completion" Deleted. The term "substantial completion," if found, is hereby deleted and is of no force in all Subcontracts and in the Trade Sections of the Contract Documents. The term is be superseded by the term "Material Completion" as defined in this Contract.

3.5.5.4 Failure to Incorporate Terms in Subcontracts. The Contractor agrees that failure on his part to incorporate this Section 3.5.5 in all Subcontracts, or Supplier contracts, is a material breach of an essential covenant of this Contract, and further agrees that in the event of such breach the Contractor shall, within five days after demand of the Owner, furnish proof in writing that the deficiency has been remedied to the end that (1) the Contractor may not maintain that it is beyond his competence to require performance of terms of the contract by a Subcontractor and (2) no Subcontractor may maintain that he has not assumed toward the Contractor all the obligations and responsibilities that the Contractor has assumed toward the Owner. Failure on the part of the Contractor to effect remedy as above within five days after receipt of written demand of the Owner shall be grounds for issuance of a declaration of default by the Owner.

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SECTION 4 – COMPENSATION

PART 1 - GENERAL

4.1.1 Payments. The Owner will make progress payments to the Contractor in accordance with Section 4 of the General Requirements. Final Payment will be made in accordance with Section 6 of the General Requirements. The date and amount of payment are subject to Section 4, Part 2. Sums retained by the Owner remain the property of the Owner until such time as the Contractor shall have become entitled to receive such payment pursuant to Section 6 of the General Requirements by furnishing the remainder of the Work and services required by the Contract Documents.

4.1.2 Application for Payments.

4.1.2.1 Form and Submission of Applications for Payment. By the twenty-fifth day (25th) of each month, the Contractor shall submit to the Owner itemized Applications for Payment on the form found in Section 7 (sometimes called a "Periodical Estimate"). For each payment requested, and, if requested by the Owner or Design Professional, shall attach backup materials including, but not limited to, receipts or other vouchers, showing his payments for materials and labor, including payments previously made to Subcontractors.

4.1.2.2 Initial Breakdown and Periodical Payments. Before the first application, shall submit to the Design Professional a Schedule of Values of the various parts of the work, including quantities, aggregating the total sum of the Contract, divided in the same manner set forth in the Application for Payment Form set forth in Section 7 showing the Contractor's right to the payment claimed and so arranged and so itemized as to meet the approval of the Design Professional and, further, if requested, supported by such evidence as to its correctness as the Design Professional may direct.

4.1.2.3 Materials Stored. If the Application for Payment includes materials delivered and suitably stored at the Site but not incorporated in the work, they shall, if required by the Owner or the Design Professional, be conditional upon submission by the Contractor of bills of sale or such other procedure as will establish the Owner's title to such material or otherwise adequately protect the Owner's interest. The Contractor is responsible for the existence, protection, and, if necessary, replacement of materials until execution of the Final Certificate of the Design Professional. The Owner shall not pay for any materials stored off-site.

4.1.2.4 Retainage.

4.1.2.4.1 Withholding of Retainage; Conversion to Lump Sum. Retainage shall be withheld from each periodic payment to the Contractor in the amount of ten percent of the sum of the total amount earned for work–in-place (original Contract), total amount earned for work-in-place (Change Orders), and Value of Materials stored at the Site. After one-half of the Contract Sum, including Change Orders becomes due and the Work meets all of the following conditions:

(a) On or ahead of the Overall Project Schedule; and
(b) There are no breaches of Notices of Non-Compliant Work; and
(c) There is no delinquency in the completion of work and filing of the final breakdown and accounting pursuant to any Change Orders utilizing a Force Account;

then, if the Contractor requests and the Design Professional approves in writing, the sum being withheld as retainage will be converted to a lump sum and held by the Owner until Material Completion.

4.1.2.4.2 Reinstatement of Retainage. The Owner will withhold no further retainage from payments to the Contractor unless one or more of the following events occur:

(a) The percentage of work complete falls behind the percentage required by the Overall Project Schedule by as much as five percent; or
(b) The Contractor breaches a Notice of Non-Compliant Work; or
(c) The Contractor becomes delinquent in regard to the filing of the final breakdown and accounting pursuant to any Change Orders utilizing a Force Account; or
(d) The Contractor commits any breach of the contract.

In this event or events the Owner shall reinstate the ten percent retainage on all Applications for Payment due to be paid while one or more of the events continues to exist. The Contractor will be given written notice of the reinstatement of the retainage.

4.1.2.4.3 Reconversion to Lump Sum. If the Contractor subsequently:

(a) Recovers all lost time and puts the work back on schedule; and
(b) Remedies all breaches of Notices of Non-Compliant Work; and
(c) Supplies a proper breakdown and accounting pursuant to any Change Orders utilizing a Force Account; then the sums withheld while either or all of the events existed will be again converted to a lump sum.

4.1.2.5 Subcontractor's Retainage Release. At the discretion of the Owner and request by Contractor, an amount equal to the subcontract retainage of a Subcontractor may be separately released from the retainage held by the Owner as he completes his work. An application in accordance with the Owner's specimen form (a copy of which will be provided upon request) for release of a Subcontractor's retainage shall contain a release of all claims by the Subcontractor and shall bear the original certificates of the Subcontractor, the Contractor, and the Design Professional that the Subcontractor's work has been fully performed and that the sum for which payment is requested is due by the Contractor to the Subcontractor. Checks releasing a Subcontractor's retainage shall be made payable to the Contractor, the Contractor's surety, and the Subcontractor and shall be mailed to the Contractor's surety. This Section does not create any contractual relationship between the Owner and the Subcontractor or any duty of the Owner to any Subcontractor.

4,1.2.6 Accounting Format. Applications for Payment shall be broken down by CSI Category and, in certain situations, by CSI Description and capital asset category, as set forth in the form for Application for Payment. The purpose is to provide appropriate backup documents for the Contractor's Final Certification of Costs in conformance with GASB 34 accounting standards. *See* Section 7 – Forms, "Application for Payment" and Final Certification of Costs.

4.1.3 Processing of Application for Payment (Periodical Estimates). The Contract Compliance Specialist (CCS) will review the Application for Payment prepared and executed by the Contractor and, if he concurs, execute a statement on the face of the Application for Payment as to its accuracy. The Design Professional shall visit the Site after the Contractor and CCS have agreed on the Application for Payment and conduct such inspections and reviews as are necessary to make a decision as to the accuracy of the Application for Payment. If the CCS and the Contractor cannot agree on the appropriateness of the Application for Payment in question, the Design Professional shall make a decision. Upon determining the appropriateness of the Application, the Design Professional shall execute the certificate on the Application for Payment and forward it to the Owner for payment. Not later than seven days after receipt of the Application for Payment, the Design Professional shall issue its certificate for such amount as it decides to be properly due or state in writing its reasons for withholding any sums in its certificate.

4.1.4 Effect of Design Professional's Certificate on an Application for Payment. No certificate issued by the Design Professional, nor payment made to the Contractor by the Owner, or partial or entire use or occupancy of the Work by the Owner shall be an acceptance of any work or materials not in accordance with the Contract Documents.

4.1.5 Payment Due. If approved by the Owner and to the extent approved by Owner, the amount of such invoice shall be paid promptly by the Owner. .

4.1.6 Payment Due Dates and Interest. Should the Owner fail to pay a proper invoice within thirty calendar days of receipt, the Contractor shall notify the Owner in writing by certified or statutory mail. If the Owner fails to pay within five business days of receipt of the notice, the Contractor shall receive, in addition to the sum named in the proper invoice, interest thereon at the rate of one half percent per month on the unpaid balance as may be due.

4.1.7 Payments for Change Order Work. Payments will not be made for any changes in the Work until a Change Order has been executed.

4.1.8 Contractor's Warranty on Applications for Payment. The Contractor hereby warrants to the Owner that, subject to Owner making payments to the Contractor in accordance with the Contract Documents:

4.3.8.1 Title to Work. Title to Work, materials and equipment covered by an approved Application for Payment will pass to the Owner either by incorporation in construction or upon receipt of payment by the Contractor, whichever shall occur first;

4.3.8.2 No Liens. Work, materials and equipment covered by any previously approved Applications for Payment are free and clear of liens, claims, security interests or encumbrances, hereinafter referred to as "liens";

4.3.8.3 No Encumbrance. No Work, materials or equipment covered by an approved Application for Payment will have been acquired by the Contractor, or any other person performing work at the Site or furnishing materials or equipment for the Project, subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller or otherwise imposed by the Contractor or such other person.

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PART 2 – PAYMENTS WITHHELD

4.2.1 Payments Withheld.

4.2.1.1 Payments Withheld or Nullified. The Design Professional or the Owner may withhold or, on account of subsequently discovered evidence, nullify the whole or a part of any certificate to such extent as may be necessary to protect the Owner from loss because of the following conditions:

(a) Defective work not remedied.
(b) Claims or liens filed
(c) Failure of the Contractor to make payments properly to Subcontractor or Supplier for materials or labor.
(d) A reasonable doubt that the Contract can be completed for the balance then unpaid.
(e) Damage to a Separate Contractor or to the Owner or a third party.
(f) Failure to maintain a rate of progress consistent with the Milestones.
(g) Failure to supply enough skilled workers or proper materials.

When the above grounds are removed, payment shall be made for amounts withheld because of them. With regard to cases (b) and (c) above, the Owner may agree to payment upon receipt of a satisfactory Bond to Discharge Claim in the amount of double the claim (*see* Section 7, Forms). At the option of the Owner adherence to the Overall Project Schedule shall be a condition precedent to the right of the Contractor to demand payment of an application for payment or certificate. No omission on the part of the Owner to exercise the aforesaid option shall be construed to be a waiver of breach of the Overall Project Schedule or acquiescence therein, and the Owner may exercise its option from time to time and as often as may be expedient.

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PART 3 - LIENS

4.3.1 Public Property Not Subject to Lien. The Contractor acknowledges that, pursuant to law, the Site is public property of the State of Georgia and is not subject to lien or levy. The Contractor will notify the Owner of any liens or levies against the Site of which it becomes aware. The Contractor shall cooperate with the Owner and shall use its best efforts to assist in securing the release of any liens or levies of which it becomes aware.

4.3.2 Notice of Commencement. (*See* Section 3.1.10).

4.3.3 Release of Liens. Neither any part of the retainage nor the Payment for Material Completion or Final Payment shall become due until the Contractor, if required, shall deliver to the Owner a complete release of all liens or conditional release of lien upon payment or claims arising out of this contract in accordance with the Owner's specimen form (a copy of which will be provided to any bidder on request), or receipts in full in place thereof and, if required in either case, an affidavit that so far as he has knowledge or information the releases and receipts include all labor and materials for which a lien or claim could be filed; but the Contractor may, if any Subcontractor or claimant refuses to provide a release, furnish a bond satisfactory to the Owner to indemnify the Owner against any lien or claim. If any lien or claim remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such lien or claim, including all costs and reasonable attorney's fees.

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SECTION 5 – CONTRACT ADJUSTMENTS, DISPUTES, AND TERMINATION

PART 1 – OWNER'S RIGHT TO SUSPEND OR STOP WORK

5.1.1 Owner's Right to Suspend Work. The Owner reserves the right to suspend the Work at any time or from time to time at the Owner's sole discretion, upon giving Contractor five days advanced written notice thereof. If the Owner exercises this right and then resumes the Work covered hereby, Contractor shall be entitled upon timely claim to a Change Order, to payment by Owner of any reasonable Actual Costs actually incurred by Contractor in connection with the suspension and resumption of the Work, as well as an extension in the time for performance of the Work to the extent Contractor is delayed by Owner's suspension.

5.1.2 Owner's Right to Stop Work. The Owner reserves the right, for itself and for any designated Construction Inspector retained by Owner, upon observation of apparent nonconforming Work, to immediately stop the affected Work at any time by oral direction at the Owner's or Construction Inspector's sole discretion, with notice to be provided to the Contractor within 72 hours. If the Work is later determined by the Design Professional to be in fact conforming Work, then Contractor, for the period commencing 72 hours after the issuance of the initial stop work order, shall be entitled, upon timely claim to a Change Order, to payment by Owner of any reasonable Actual Costs actually incurred by Contractor in connection with the stop Work order and resumption of the Work, as well as an extension in the time for performance of the Work to the extent Contractor is delayed by Owner's stop Work order beyond the initial 72 hours.

5.1.3 Owner's Rights Independent from Rights and Duty of the Design Professional. The rights granted to Owner under this Section are independent of the duty and obligation of the Design Professional to stop the Work for non-compliant work or to issue Notices of Non-Compliant Work.

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PART 2 – CONTRACT ADJUSTMENTS AND DISPUTES

5.2.1 General Provisions.

5.2.1.1 No Arbitration. There is no agreement to arbitrate any dispute arising under the Contract Documents. Any and all references to arbitration in any of the Contract Documents, including without limitation any exhibits, attachments or references, are hereby deleted and rendered null and void.

5.2.1.2 Continuation of the Work. Unless otherwise agreed in writing, and notwithstanding any other rights or obligations of either of the parties under any Contract Documents or Contracts, the Contractor must carry on with the performance of its contract services and the Work, including all duties and obligations hereunder, during the pendency of any Claim, dispute, and other matter in question or during any alternative dispute resolution proceeding, court proceeding, or other proceeding to resolve any Claim, dispute, and other matter in question, and the Owner will continue to make payments in accordance with the Contract Documents. The Owner, however, is under no obligation to make payments on or against such Claims, disputes, and other matters in question during the time required to resolve such Claims, disputes, and other matters in question.

5.2.2 General Claims for Contract Adjustments and Disputes.

5.2.2.1 General Claims of the Contractor. Budgeting and cash flow being of material importance to the Owner, should the Contractor suffer any injury or damage to person or property that Contractor reasonably believes a legal basis exists for liability on the part of the Owner or Design Professional, and that should result in an adjustment in the Cost of the Work or the Contract Time, such claim shall be made in writing in the form of a Request for Change Order to the Owner within fourteen (14) days after such injury or damage is or should have been first observed. Any and all claims not made within said fourteen (14) days are barred, waived, released, and discharged.

5.2.2.3 Protest; Statement of General Claim; Time of Submission. No protest of the Owner's claim decision by the Contractor, whether said claim shall be accrued or prospective, shall be valid unless a "Statement of Claim" in writing and accompanied by vouchers and other supporting data shall have been filed with the Owner's Representative, or if there is no Owner's Representative, with the Owner by the Contractor not later than thirty days after the Design Professional's decision to reject the claim, time being of the essence. The "Statement of Claim" shall contain a concise and clear recital of the grounds and the legal basis upon which the claim is asserted, including a designation of the applicable provisions of the Contract Documents. The Statement of Claim shall indicate the dollar amount of the claim and the number of days of adjustment of the Contract Time.

5.2.2.3 Certain Claims Excluded from General Claims.

5.2.2.3.1 All claims for Unavoidable Delay as defined in Section 3.3.8 must be filed and processed pursuant to Section 3.3.10 and are subject to the limitations of Sections 3.3.7 and 3.3.9

5.2.2.3.2 All claims concerning designation of a Sole Source must be filed and processed pursuant to Sections 3.2.15 and are subject to the provisions and limitations therein.

5.2.3 Dispute Resolution.

5.2.3.1 Initial Dispute Resolution. If a dispute arises out of or relates to this Contract or its breach, the parties shall endeavor to settle the dispute first through direct discussions between the parties' representatives who have the authority to settle the dispute. If the parties' representatives are not able to promptly settle the dispute, they shall refer the dispute to the senior administrators of the parties who have the authority to settle the dispute, who shall meet within fourteen days thereafter. If the dispute is not settled by the senior administrators, the parties may submit the dispute to mediation in accordance with Section 5.2.3.2.

5.2.3.2 Mediation. If the dispute cannot be settled pursuant to Section 5.2.3.1, the parties may elect to submit the dispute to mediation. The parties agree to conclude such mediation within sixty days of electing mediation. The parties shall select a mutually agreeable mediator and shall share the cost of the mediator equally. Either party may terminate the mediation at any time after the first session, but

the decision to terminate shall be communicated directly by the party's representative to the other party's representative and the mediator.

5.2.3.3 Multiparty Proceeding. All parties necessary to resolve a claim shall be parties to the same dispute resolution proceeding and shall share the costs equally. Appropriate provisions shall be included in all other contracts relating to the Work to provide for the consolidation of such dispute resolution procedures.

5.2.3.4 No Litigation. No litigation may be commenced without first following the process in this Section. Litigation may be filed in the Superior Court of Fulton County, Georgia, pursuant to OCGA §50-21-1, after the filing party provides thirty days written notice to the opposing party. The parties hereby agree that the Superior Court of Fulton County, Georgia shall have exclusive jurisdiction and venue in all maters concerning this contract.

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PART 3 - TERMINATION

5.3.1 Owner's Right to Terminate Contract for Convenience.

5.3.1.1 Termination for Convenience. The Owner may at any time, and for any reason or without any reason or cause, terminate this Contract by written notice to the Contractor specifying the termination date, without cause and irrespective of whether or not Contractor is in default of any of its obligations hereunder. The effective date of termination shall not be earlier than seven days from the date of confirmed receipt of the written notice.

5.3.1.1.1 The Contractor shall: (i) stop the Services or the Work (as applicable); (ii) place no further orders or Subcontracts for materials, labor, services or equipment; and (iii) terminate all material and equipment orders and Subcontracts to the extent terminable (unless otherwise directed by Owner in writing) and advise Owner of all materials, equipment and other items which cannot be canceled or which are already delivered and allow Owner to participate in the salvage or disposition thereof.

5.3.1.1.2 If Owner terminates this Contract pursuant to this Section prior to the commencement of the Construction Stage, Contractor shall, as soon as practical after receiving notice of termination under Section 5.3.1.1, submit to Owner an Application for Payment for all services performed through the date of receipt of the notice of termination, for which payment has not been previously made pursuant to the terms of this Contract.

5.3.1.1.3 If Owner terminates this Contract pursuant to this Section after commencement of the Construction Stage, Contractor shall, as soon as practical after receiving notice of termination under Section 5.3.1.1, submit to Owner an Application for Payment showing all of the costs incurred by Contractor in the performance of the Work terminated through the date of receipt of the notice of termination. The phrase "costs incurred by Contractor in the performance of the Work terminated" as used herein shall be deemed to include:

(i) Subcontract costs of Work completed;
(ii) Cancellation fees in regard to equipment and materials ordered;
(iii) Cost of all materials and equipment ordered which cannot be cancelled; less actual proceeds received upon the disposition thereof;
(iv) Field Work accomplished;
(v) Permit, engineering, bond and inspection fees;
(vi) All other direct costs actually incurred by Contractor that can be demonstrated by invoice, canceled check, or other appropriate documentation;
(vii) General Requirements costs and profit incurred through the date of termination.
(viii) Job Site and termination costs for ten business days after the date of termination..

5.3.1.2, Acceptance of Payment. Acceptance of payment by the Contractor shall constitute a waiver of all further claims by Contractor against Owner under the Contract, and shall be Contractor's exclusive remedy for termination of the Contract.. Notwithstanding anything to the contrary contained in the Contract Documents, in no event shall Contractor be entitled to any payment on account of accident or lost profits or consequential damages in connection with any termination of the Contract, or otherwise in connection with the Contract.

5.3.1.3 Condition Precedent to Payment. As a condition precedent to receiving the payment set forth in this Section 5.3.1, Contractor shall deliver to the Owner all papers, documents, assignments and agreements relating to the Project, in particular the Contract Documents (including ownership and copyright thereof) as set forth in Sections 1.1.7, 1.1.9.18 and 2.2.1.8.

5.3.1.4 Assignment of Rights Subcontracts.

5.3.1.4.1 Assignment. If requested, Contractor shall assign to the Owner or to an entity of Owner's choice any or all of Contractor's contractual rights in respect thereof, so that the assignee shall be fully vested with all rights and benefits of Contractor under such papers, documents and agreements, together with releases and waivers of lien in the same manner as would be required upon Final Completion. The Owner may also request the assignment from Contractor to Owner or to the entity of Owner's choice of any or all Subcontractors and Supplier agreements entered into by Contractor and in that event the assignee shall be solely obligated to the Subcontractors and Suppliers under such contracts or agreements for all sums payable thereunder and not previously paid by the Owner to Contractor.

5.3.1.4.2 Cessation of Entitlement. Upon the Contractor's assignment of agreements, contracts, subcontracts and/or Owner's payment of monies due Contractor as provided in Subparagraph 5.3.1.4.1 above, Contractor shall be entitled to no further compensation of any kind from Owner and shall have no further obligation with regard to the assigned agreements, contracts, or subcontracts .

5.3.2 Owner's Right to Declare Default and/or Terminate Contract for Cause.

5.3.2.1 Termination for Cause. In the event that any provisions of this Contract are violated by the Contractor, through its own forces or by any of its Subcontractors, the Owner may serve written notice upon the Contractor and the surety of the Owner's intention to declare default and terminate the Contractor. Unless within ten days after the serving of such notice upon the Contractor, such violation or delay shall cease and satisfactory arrangement of correction be made, the Contractor shall, upon the expiration of said ten days, be in default. Such notices shall outline the reasons for such intention to terminate the contract. In the event of any such default, the Owner shall immediately serve notice thereof upon the surety and the Contractor, and the Owner shall demand that the surety perform in accordance with its bond. If the surety fails to exercise its election under the bond or does not commence performance thereof within the time required by the bond, the Owner may take over the Work and prosecute the same to completion for the account of and at the expense of the Contractor. The Contractor and its surety shall be liable to the Owner for any excess cost to the Owner. The Owner may take possession of and utilize in completing the Work such materials, appliances, and plant as may be on the Site and necessary thereto.

5.3.2.2 Grounds for Issuance of Notice of Declaration of Default. It shall be a sufficient ground for the issuance of a notice of declaration of default that the Contractor has been unfaithful or delinquent in the performance of the Contract or any part of it in any respect. The Design Professional does not have authority to declare the Contractor in default.

5.3.2.2.1 Non-Compliant Work. Without limitation of the foregoing and without subtracting from any right or defense of the Owner under other provisions of the Contract Documents, the Contractor acknowledges and agrees that it is grounds for issuance of a notice of declaration of default under the performance bond if the Contractor shall have neglected or failed for any reason to remedy a breach of a Notice of Non-Compliant Work within thirty days after the Owner shall have given written notice of said breach to the Contractor.

5.3.2.2.2 Failure to Prosecute the Work. If the Contractor refuses or fails, except in cases for which extensions of time are provided, to supply enough properly skilled workmen or proper materials, or if it fails to make proper payment to Subcontractors for materials or labor, or if it fails to diligently prosecute the Work in accordance with the Contract Documents, then the Owner may, without prejudice to any right or remedy and after giving the Contractor and its Surety, ten days' written notice of the Owner's Intent to Declare Default, during which period the Contractor fails to cure or fails to commence and thereafter diligently prosecute Work necessary to cure the violation, declare the Contractor to be in default.

5.3.2.2.3 Other Failures of the Contractor. If Contractor, without limitation, makes a general assignment for the benefit of its creditors, or if a receiver is appointed on account of its insolvency, or if it persistently disregards laws, ordinances, rules, regulations or orders of any public authority having jurisdiction over the Project, or if it otherwise is guilty of a violation of any provision of this Contract, then the Owner may, without prejudice to any right or remedy and after giving the Contractor and its Surety, if any, ten days written notice of the Owner's Intent to Declare Default, during which period the Contractor fails to cure or fails to commence and thereafter diligently prosecute Work necessary to cure the violation, declare the Contractor to be in default.

5.3.2.3 Owner's Right to Prosecute the Work. Time being of the essence, if the Contractor shall be declared in default, both the Contractor and the Surety agree that the Owner may, after giving the Contractor and Surety the required notice and time if any is required, without prejudice to any other remedy and without invalidating the performance bond, make good such deficiencies and may deduct the cost thereof from payment due the Contractor or, at the Owner's option and without prejudice to the Owner's rights against the Contractor and Surety, the Owner may terminate the Contractor and take possession of the Site and of all materials, equipment, tools and construction equipment and machinery thereon owned by the Contractor and finish the Work by whatever method the Owner shall deem expedient.

5.3.2.4 Effect of Later Determination. In the event the parties agree or a court of competent jurisdiction determines (or the parties agree to settle with a consent determination) that a default is wrongful or not the fault of the Contractor, the termination shall be considered to be a Termination for Convenience and the sole remedy available to the Contractor shall be the contractual treatment of the termination pursuant to Section 5.3.1 above and without any other damages or relief.

5.3.3 Contractor's Right to Terminate.

5.3.3.1 Contractor's Right to Stop Work. The Contractor may, upon seven days written notice to the Owner and the Design Professional, stop Work without penalty for the following reasons:

5.3.3.1.1 Order of Court or Superior Public Authority. If any court or other superior public authority issues an order that affects the Work and the order results from no act or fault of the Contractor, the Contractor may stop the affected Work. In addition, the Contractor may stop Work as a result of an act of government, such as a declaration of a national emergency, making critical materials unavailable.

5.3.3.1.2 Failure to issue Certificate of Payment. Work may be stopped if the Design Professional should fail to certify any Application for Payment within fourteen days after said certification is due from the Design Professional. This ground terminates upon any payment of the Application for Payment by the Owner.

5.3.3.2 Contractor's Right to Terminate Contract.

5.3.3.2.1 Contractor's Right to Terminate for Nonpayment. If the Owner fails to pay the Contractor when payment is due, the Contractor must give written notice of the Contractor's intention to terminate this Contract. If the Owner fails to provide the Contractor payment or written notice of a dispute as to the amount sought by the Contractor within thirty days after receipt of the Contractor's written notice, the Contractor may terminate this Contract. Upon such termination the Owner will pay the Contractor for the Work properly executed to date, and, upon timely claim therefore, for any proven loss sustained or cost incurred upon any materials, equipment, tools, construction equipment and machinery, and cancellation charges on existing obligations of the Contractor.

5.3.3.2.2 Contractor's Right to Terminate after Stopping Work. After stopping its Work in accordance with Section 5.3.3.1 above, the Contractor may, upon thirty days written notice to the Owner and the Design Professional, terminate this Contract and recover from the Owner payment for all Work executed and any proven loss sustained or incurred upon any plant or any materials, equipment, tools, construction equipment and machinery, and cancellation charges on existing obligations of the Contractor, if the grounds for stopping the Work are not removed.

5.3.4 Limitation on Payments. For terminations pursuant to Section 5.3.2 and 5.3.3, the Contract Sum shall be deemed earned only to the extent of an amount that bears to the total Contract Sum the same ratio that the Work in place at the time of termination bears to the total Work, as reasonably determined by the Design Professional, and approved by the Owner.

5.3.5 Termination by Owner for Abandonment by Contractor. Both the Contractor and the Surety agree that, after fourteen calendar days' written notice to the Contractor, the Owner may terminate the Contractor if the Contractor abandons the Project. If such termination occurs, the Owner shall credit the Contractor for Work satisfactorily completed, less any costs and liquidated damages the Owner suffers in correcting the Work, re-contracting and starting-up a replacement contractor, and completing the Project, including all warranties.

5.3.6 Notices of Termination. Notwithstanding any other provision of this Contract, no party may terminate this Contract, regardless of reason, unless the terminating party shall first issue a written Notice of Termination or of Default to the terminated or defaulted party by Statutory Mail or Certified Mail, Return Receipt Requested.

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SECTION 6 - PROJECT COMPLETION

PART 1 – PREPARATION FOR MATERIAL COMPLETION

6.1.1 Prerequisites.

6.1.1.1 Completion of the Work. The Contractor must obtain Material Completion as defined in Section 6.1.2 below prior to any occupancy of the Project.

6.1.1.2 Submission of Final Documents. All Final Documents as defined herein are due at Material Completion.

6.1.1.3 Operation of Building Systems. All building systems specified in Section 6.2.1.2.7 are to be started up and tested to confirm operation. In accomplishing this certification, the Contractor shall obtain the manufacturer's certificates and coordinate the initial start-up and testing of building systems. The Contractor expressly agrees that the manufacturers are solely the agents of the Contractor. In all cases where the equipment of two or more manufacturers ties in and functions together, the Contractor shall require the field representatives to perform simultaneously the initial start-up, the testing, and the placing of their equipment into operation. "Start-up" is defined as putting the equipment into action. "Testing" is defined as performing such testing as is stipulated in the Contract Documents to be performed. "Placing into operation" is defined as operating the equipment for a sufficient period of time for the determination to be made that it is performing properly. All building commissioning activities should be completed, with the exception of those designated as "Permitted Incomplete Work."

6.1.1.4 Operation and Maintenance Training. Prior to Material Completion, the Contractor shall furnish advance copies of proper written instructions to the Owner and Using Agency on operation and maintenance of all mechanical, electrical and other operating systems and equipment. The Contractor shall provide training in the operation and maintenance of all mechanical, electrical and other operating systems and equipment in the presence of the Design Professional and Owner to the Using Agency and shall give notice in writing to the Design Professional, Owner and Using Agency at least fifteen (15) days prior to the date it is proposes for the training. The presence of a Commissioning Authority shall not diminish the responsibility of the Contractor to perform and administer this Operation and Maintenance Training.

6.1.1.5 Operation and Maintenance Manuals, Brochures and Data. At least seven (7) days prior to the proposed date of Inspection for Material Completion, the Contractor shall furnish and deliver to the Design Professional complete manuals, brochures and data as prepared and published by the manufacturers covering details of operation and maintenance for all items equipment, systems or apparatus installed which require operation or maintenance after occupancy. The Design Professional will review this submittal for compliance and deliver documents to the Owner and Using Agency at Material Completion. The review services of the Design Professional may be supplemented or performed by a Commissioning Agent if the Owner directs.

6.1.1.6 Test and Balance Report. A copy of the initial test and balance report on the heating, ventilating and air conditioning system shall be submitted to the Design Professional at least seven (7) days prior to the proposed date of Inspection for Material Completion. Two additional Test and Balance Reports are required after Material Completion (*See* Section 6.4.7).

6.1.2 Material Completion.

6.1.2.1 Material Completion Defined. Material Completion is when the Work or designated portion thereof is complete in accordance with the Contract Documents so that the Owner and its Using Agency can occupy and utilize the Work for its intended use. Material Completion shall require building commissioning and complete operation of all applicable building systems including, but not limited to, mechanical, electrical, plumbing, fire protection, fire alarm, telecom, data, security, elevators, life safety, and accessibility. The Work shall be complete except for Minor Items or Permitted Incomplete Work or Warranty Complaint Items (*See* Section 6.6.3).

6.1.2.1.1 Minor Item Defined. A Minor Item is a portion or element of the Work:

(a) that can be totally complete within thirty (30) days; and

(b) that can be completed while the Using Agency occupies the Work without impeding or interfering with either the Using Agency's use and occupation of the Work or the Contractor's ability to complete the Minor Item; and

(c) that will not interfere with the complete use and enjoyment of the project by the Using Agency.

6.1.2.1.2 Permitted Incomplete Work Defined. Permitted Incomplete Work is work that is incomplete through no fault of the Contractor, as determined by the Owner, including, but not limited to, HVAC seasonal test and balance (*See* Section 6.4.7), seasonal landscaping or maintenance, scheduled elevator/escalator inspection or maintenance, incomplete work due to failure of Separate Contractors to complete work, and the like.

6.1.2.2 Material Completion Date. Material Completion shall be achieved on or before the Material Completion Date specified in the Contract as amended by Change Orders. Failure by the Contractor to achieve Material Completion by the Material Completion Date, as amended, shall be sufficient cause for the assessment of Liquidated Damages.

6.1.2.3 No Partial Occupancy; Exceptions. No partial occupancy of the Project or the Work shall be permitted, unless expressly addressed in the Supplementary General Requirements or elected by the Owner via a properly executed Change Order. In the event the Owner otherwise elects to have a partial occupancy of the Project after execution of this agreement, which decision shall be at the sole discretion of the Owner, a Change Order will be executed. A partial occupancy will follow all the requirements for Material Completion for the specific area of the Project that is to be accepted and turned over to Owner.

6.1.3 Effect of Achieving Material Completion. Upon the date when Material Completion is achieved, the following matters are conclusively determined:

6.1.3.1 Occupancy of the Work. The Using Agency may immediately occupy and secure the Work without restriction except as provided in Section 1 Part 4 and Sections 1.7.4 and 6.4.5.

6.1.3.2 Warranty Periods. All warranties begin to run from the date Material Completion is achieved.

6.1.3.3 Utilities. All utilities become the responsibility of the Using Agency.

6.1.3.4 Insurance. The Using Agency is responsible for all insurance for the Project.

6.1.3.5 Liquidated Damages. The Liquidated Damages daily rate is reduced to zero.

6.1.3.6 Payment for Material Completion. The Contractor may request payment of the remaining contract balance, including retainage, less amounts credited the Owner or incurred as liquidated damages, and less amounts withheld for the Punchlist by reason of Minor Items or Permitted Incomplete Work (*See* Section 6.6.3.2).

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PART 2 – DOCUMENTS AND DELIVERABLES

6.2.1 Final Documents Due at Material Completion.

6.2.1.1 Final Documents Defined. Final Documents consist of all certificates, warranties, guarantees, manuals, instructions and documents as required by the Contract Documents.

6.2.1.2 Schedule of Delivery of Final Documents. All Final Documents are due at Material Completion. Certain documents require prior approval from the Design Professional and other documents and deliverables require coordination with the Using Agency. The Contractor shall coordinate the assemblage, approval and delivery of Final Documents to correlate with the scheduled Material Completion Date and completion of the Construction Professional's Checklist for Material Completion (Section 7 Forms). These documents and deliverables include but are not limited to the following:

6.2.1.2.1 Affidavits.

(a) A non-influence affidavit in the exact form as shown in Section 7, Forms.

(b) A statutory affidavit in the exact form as shown in Section 7, Forms.

6.2.1.2.2 Bonds.

(a) A Five Year Bond of Roofs and Walls as shown in Section 7, Forms, written by a surety authorized to do business in the State of Georgia and in the penal sum of the actual cost of the walls, wall cladding, wall insulation, roof, insulation and roof deck, but not less than the amount shown in the approved initial breakdown for roof and wall systems. The effective date of the Bond shall be the Material Completion Date.

(b) Any Bonds to Discharge Claim issued to Trade Contractors and suppliers as shown in Section 7, Forms.

6.2.1.2.3 Written Guarantees and Warranties. All written guarantees or warranties as called for in the Specifications. Each written guarantee or warranty shall specify the term and contact information for enforcement and shall be in such form as to permit direct enforcement by the Owner against any Trade Contractor, subcontractor, materialmen, or manufacturer related to the guarantee. The effective date of all warranties and guarantees shall be the Material Completion Date.

6.2.1.2.4 Marked-up Construction Documents. The Contractor shall provide a complete set of Marked-up Construction Documents to the Design Professional, which set shall reflect all changes caused by addenda, field changes, Change Orders, or observed changes by the Contractor or subcontractor(s) for the purpose of the Design Professional's issuance of Record Documents to the Owner.

6.2.1.2.5 Operation and Maintenance Manuals. Receipts for transmittal of Operation and Maintenance Manuals, Brochures and Data to the Design Professional (or Commissioning Agent) as required by Section 6.1.1.5.

6.2.1.2.6 Certification of Building Systems' Operations. A certification by the Contractor that all building systems specified in Section 6.2.1.2.7 are operational. The Contractor expressly agrees that the manufacturers are solely the agents of the Contractor. In accomplishing this certification, the Contractor shall obtain the manufacturer's certificates and coordinate the initial start-up and testing of building systems.

6.2.1.2.7 Certificates of Manufacturers for Major Components. For elevators, moving walks, dumbwaiters, escalators, lifts, major components of air conditioning systems (i.e., cooling towers, compressors, condensers, absorption units, chiller units, fan coil units, air handling units, boilers, base mounted pumps, and temperature controls); major components of heating systems (i.e., boilers, base mounted pumps, air handling units, unit ventilators, fan coil units,

temperature controls, and boiler chemical feed systems); major components of plumbing systems (i.e., boilers, base mounted pumps, sewage pumps and water treatment systems) and incinerator systems; start-up, testing, and placing into operation shall be performed by the field representative(s) of the manufacturer(s), and certificate(s) of the manufacturer(s) shall be filed with the Owner on the letterhead(s) of the manufacturer(s) in which the manufacturer(s) certifies or certify that "the equipment has been installed in strict compliance with the recommendations of the manufacturer(s) and is operating properly," in the format shown in Section 7, Forms. The manufacturer shall list in the certificate the item or items furnished to the job and the date, name, or other positive means of identifying any supplementary documents containing the recommendations of the manufacturer, with a copy of each of the supplementary documents attached to the certificate.

6.2.1.2.8 Certificates of Manufacturers for Products. Where required by the specifications, Certificates of Manufacturers for products and other materials (not Major Components) shall be provided using the manufacturer's certificate format.

6.2.1.2.9 Final Certification of Costs. For proper capital asset reporting of the Project, the Contractor shall submit his Final Certification of Costs in the format set forth in Section 7, Forms.

6.2.1.3 Presentation of Final Documents. Final Documents will be arranged by category and delivered at or before Material Completion is a format suitable for the presentation, use and retention of the documents. Three (3) sets of each document are required with originals in one set of documents.

6.2.1.3.1 Warranties, Guarantees, and Manufacturer's Certificates shall be in a separate three ring binder(s) with summary list of contents. After approval Owner shall retain the original set and furnish two copies to Using Agency.

6.2.1.3.2 Affidavits and Bonds shall be presented in a separate three ring binder. After approval, Owner shall retain the original set and furnish two copies to Using Agency.

6.2.1.3.2 Operation and Maintenance Manuals shall be in three ring binders or manufacturer's binder. If documents are provided on electronic format (CD/DVD), one printed copy is required plus two (2) disks. After approval Owner shall furnish Using Agency original set plus two copies.

6.2.2 Deliverables

6.2.2.1 Keys. Keys with tags attached indicating number and/or description of door or room each key is intended to fit attached to each key shall be delivered to the Owner and Using Agency. Contractor shall prepare and furnish with the keys an itemized key schedule in quintuplicate listing the door or room number and/or description, serial number of key, and number of keys being delivered for each door or lock.

6.2.2.2 Attic Stock and Loose Equipment. If the Contract Documents provide for the furnishing of any loose equipment or furnishings or attic stock of materials, the Contractor shall make arrangements to locate such material in a secure location at the Project site to facilitate inspection by the Design Professional, Owner and transfer to the Using Agency at Material Completion.

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PART 3 – INSPECTIONS FOR MATERIAL COMPLETION

6.3.1 General Responsibility of the Contractor for Inspection. The Contractor acknowledges and agrees that he has an indivisible, non-delegable, and nontransferable contractual obligation to the Owner to make his own inspections of the Work at all stages of construction; and he shall supervise and superintend performance of the Contract in such manner as to enable him to confirm and corroborate at all times that all work has been executed strictly, literally, rigidly, and inflexibly in accordance with the methods and materials designated in the Contract Documents. The Contractor's inspections are also for the purpose of permitting the Contractor to accurately represent that (a) his certifications on Applications for Payment are true and correct and (b) his notices of readiness for inspections are true and correct. Accordingly, the Contractor acknowledges and agrees that he may not defend or excuse any deviation from the Contract Documents on the ground (a) that the deviation was not brought to his attention by another person or party or other persons or parties or (b) that a subcontractor is or subcontractors are at fault.

6.3.2 Notice of Readiness for Inspection for Material Completion.

6.3.2.1 Preparation of Initial Punchlist. Prior to the Material Completion Date, the Contractor shall correct all non-compliant Work. The Contractor shall then prepare an "Initial Punchlist" itemizing to the best of the Contractor's knowledge all Minor Items and Permitted Incomplete Work (as defined in Section 6, Part 1) and provide a copy of the Initial Punchlist to the Design Professional and Owner. The Contractor is encouraged to consult with the Design Professional and Owner prior to finalizing the Initial Punchlist, in particular in arriving at consensus for Minor Items and Permitted Incomplete Work.

6.3.2.2 Notice of Readiness for Inspection for Material Completion. After or simultaneously with the provision of the Initial Punchlist, the Contractor shall give the Design Professional and Owner written notice requesting inspection for Material Completion in the following words:

"The work on the Contract for the [SHOW NAME OF PROJECT AS IT APPEARS IN THE CONTRACT] having been materially completed, it is requested that an Inspection for Material Completion be made promptly by the Design Professional in accordance with Section 6 of the General Requirements. The Initial Punchlist, to the best of the Contractor's knowledge, is attached hereto."

6.3.2.3 No Inspection without Notice. No Inspection for Material Completion shall be made until such time as the Design Professional and Owner have received notice in the exact form indicated above. In the event the Contractor shall have issued the "Notice of Readiness for Inspection for Material Completion " prematurely, hereinafter referred to as a "false start," the Contractor shall be liable for the damage resulting from the false start including, but not limited to, additional fee claims from the Design Professional for extra site visits.

6.3.3 Conducting the Inspection for Material Completion. The Design Professional shall conduct the Inspection for Material Completion. The Design Professional shall confirm the Initial Punch List and shall add or delete such Minor Items or Permitted Incomplete Work as shall be appropriate. Where appropriate, the Design Professional shall assign completion dates for the items of Permitted Incomplete Work. At the completion of the Inspection for Material Completion, the resulting punch list shall become the "Final Punch List" and also documented as a final "Notice of Non-Compliance".

6.3.4 Executing Material Completion Certificates by the Using Agency. When the Design Professional completes the Final Punch List (Five (5) days allowed), the Owner, Contractor, Design Professional and Using Agency are prepared to execute the Material Completion Certificates (*See* Section 7 Forms) for occupancy. The Owner administers the execution and distribution of the Material Completion certificates on the Material Completion date.

6.3.4.1 Construction Professional's Material Completion Checklist. This form is a recital of submittals and requirements for Material Completion provided as a guide to this Section 6 Project Completion.

6.3.4.2 Design Professional's Certificate of Material Completion. This certificate confirms inspection of the work by the Design Professional and representation as to Material Completion; establishes the Final Punchlist (Notice of Non-Compliance); and, recommends the amount to be withheld as contingency.

6.3.4.3 Using Agency's Certificate for Material Completion . This certificate authorizes the Using Agency to occupy the Work, secure the site and assume operations.

6.3.5 Notification of Using Agency of Site Visits by the Contractor or Subcontractors. Following the successful completion of the Inspection for Material Completion the Contractor and his Subcontractors shall make no visits to the site without first giving notice to the Using Agency and the Owner.

6.3.6 Effect of Failure to Achieve Material Completion. Should Material Completion not be achieved by the Material Completion Date, as amended, the following matters are conclusively determined:

6.3.6.1 Breach of Covenant of Time. As time is of the essence in the completion of the Work, the Contractor is in breach of the covenant of time and is subject to default.

6.3.6.2 Liquidated Damages. Liquidated Damages at the specified daily rate in the Contract begin to accrue and are payable on the day immediately following the Material Completion Date.

6.3.6.3 Extension of Time. While it is anticipated that all applications of the Contractor for additional time or extensions of the Material Completion Date would have been filed and determined by the Owner prior to the Material Completion Date, the Contractor may, within 10 days after the Material Completion Date, file for any additional extensions of time pursuant to Section 3, Part 4, and the collection, but not the accrual, of Liquidated Damages shall be suspended until the Owner's decision. Should such a belated application be filed after the 10-day period, the Owner, in its sole discretion, may continue to collect Liquidated Damages. Should the Owner grant any applications for extension of time and the Material Completion Date, Liquidated Damages shall be adjusted accordingly.

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PART 4 – PAYMENT FOR MATERIAL COMPLETION

6.4.1 Payment for Material Completion. Payment for Material Completion shall be due 10 days after receipt by the Owner of the application for payment upon achievement and certification of Material Completion. Payment shall be made by a check payable jointly to the Contractor and surety and shall be mailed to the surety.

6.4.2 Application for Payment for Material Completion.

6.4.2.1 Certification of Contractor. The Contractor shall certify, by his own signature, that the Work provided for by the Contract Documents has been completed under the terms and conditions thereof, and that the entire balance of the contract, including retainage, is due and payable, except for those amounts determined by the Design Professional to be withheld due to credits due to the Owner and Minor Items or Permitted Incomplete Work pursuant to Section 6.6.3 below.

6.4.2.2 Supporting Documentation.

6.4.2.2.1 Financial Data. The Contractor shall submit evidence satisfactory to the Design Professional that all payrolls, material bills, and other indebtedness connected with the work have been paid.

6.4.2.2.2 Affidavits and Bonds. The Contractor shall attach copies of the affidavits and bonds set forth in Sections 6.4.2.2.1 and 2 above, execute the payment certification, and forward it directly to the Design Professional.

6.4.3 Release of Contractor's Retainage.

6.4.3.1 Establishment of List. At the completion of the Inspection for Material Completion, the Design Professional and Contractor, with the consent of the Owner, shall develop the Final Punchlist. The Design Professional will assign a value for each the Minor Items and Permitted Incomplete Work and issue the Final Punchlist within five (5) days after the date of Inspection for Material Completion.

6.4.3.2 Establishment of Amount to be Withheld for Punchlist Items. In general, the amount to be withheld from the Payment for Material Completion and to be paid upon Final Completion shall be equal to 200% of the Design Professional's value of completing the Work for each Minor Item or Permitted Incomplete Work. The following additional amounts to be withheld shall be applied where applicable.

6.4.3.2.1 Mechanical and HVAC Systems. Until such time as the Design Professional shall have certified that the heating system has been balanced under seasonable weather conditions, the amount withheld shall in no event be less than $1,000.00.

6.4.3.2.1 Certificates. For each certificate required for major components a sum of $500.00 shall be withheld until such certificate shall have been filed with the Owner and Institution.

6.4.4 Effect of Payment for Material Completion and Release of Claims. Owner shall process the Payment for Material Completion as expeditiously as possible in accordance with the certification of the Design Professional, but interest shall not accrue until thirty (30) days have elapsed from receipt, unless error is found in the application or supporting documents. Acceptance of Payment for Material Completion by the Contractor shall operate as settlement, waiver, release, discharge and payment in full of all claims against Owner of any nature arising out of the Project except for the work associated with the Minor Items and the Permitted Incomplete Work.

6.4.5 Notification of Readiness for Interim Inspection for Punchlist Completion. Not more than 30 days after Material Completion, and upon completion of the Final Punchlist (including *all* Minor Items and such Permitted Incomplete Items as are due to be completed), the Contractor shall give the Design Professional and Owner written notice requesting inspection for Final Completion in the following words:

"The work on the Contract for the [SHOW NAME OF PROJECT AS IT APPEARS IN THE CONTRACT] having been 100% completed, except for Permitted Incomplete Work not yet due to be completed, it is requested that an Inspection for Final Completion be made promptly by the Design Professional in accordance with Section 6 of the General Requirements."

No Inspection for Interim Inspection for Punchlist Completion shall be made until such time as the Design Professional and Owner have received notice in the exact form indicated above. In the event the Contractor shall have issued the "Notice of Readiness for Interim Inspection for Punchlist Completion " prematurely, hereinafter referred to as a "false start," the Contractor shall be liable for the damage resulting from the false start including, but not limited to, the salaries, professional fees, and travel and living expenses of the persons or parties inconvenienced by the false start.

6.4.6 Conducting the Interim Inspection for Punchlist Completion. The Design Professional shall conduct the Interim Inspection for Punchlist Completion. The Design Professional shall confirm the Final Punch List has been completed including *all* Minor Items. Upon successful completion of the inspection, the Design Professional shall issue a Report of Interim Inspection for Punchlist Completion, noting any Permitted Incomplete Work which remains to be accomplished and the date by which it is to be completed. In the event *all* Permitted Incomplete Work has been completed at the time of this Interim Inspection, and the Design Professional so certifies, then this inspection shall be deemed an Inspection for Final Completion. In the event any Minor Item is determined to be incomplete, the Owner may give the fourteen (14) day notice of failure to complete the Work set forth in Section 6.2.3.

6.4.7 Seasonal Test and Balancing of HVAC Systems. The Contractor shall provide two additional Test and Balance Reports after the Material Completion Date by the Using Agency. One Report shall be prepared on or about the peak cooling season and the second on or about the peak heating season. These two reports are in addition to the Initial Test and Balance Report submitted at Material Completion and prior to occupancy.

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PART 5 – CORRECTION OF WORK AFTER MATERIAL COMPLETION

6.5.1 Non-Compliant or Defective Work.

6.5.1.1 Duty to Correct. Neither (1) the Design Professional's Certificate of Material Completion, (2) nor any decision of the Design Professional, (3) nor payment, (4) nor any provision in the Contract shall relieve the Contractor of responsibility for faulty materials, faulty workmanship, or omission of contract work, and he shall remedy any defects or supply any omissions resulting therefrom and pay for any damage to other work resulting therefrom.

6.5.1.2 Notice of Non-Compliant or Defective Work. The Owner shall give notice of observed defects or omissions with reasonable promptness. The notice shall be in the form of a Warranty Complaint letter, sent by statutory mail or electronic transmission to the Contractor by the Owner; or, a Notice of Non-Compliant Work issued by the Design Professional (Section 3 Part 6).

6.5.2 Warranty Complaint Procedure.

6.5.2.1 Notice of Warranty/Guaranty Complaint Items. The Owner acknowledges that many malfunctions in building equipment and systems do not constitute Non-Compliant or defective Work. Accordingly, the Owner may provide notice of such apparent warranty work by a Warranty Complaint letter, sent by statutory mail or electronic transmission to the Contractor. The letter should outline, in non-technical language, the complaint item. In emergency situations, the initial notification may be oral by the Owner or Using Agency to a person or office designated by the Contractor. The Contractor shall respond promptly to all such notices.

6.5.2.2 Duty to Correct. During the one year period of the warranty and guarantee any defects of material or workmanship that become apparent shall be the responsibility of the Contractor until and unless the Contractor can show abuse or design defect. The Contractor shall immediately correct all defects that become known during the one year period at no cost to the Owner unless notice is given to the Design Professional and Owner and Using Agency, prior to correcting the defect that the cause of the defect is the result of abuse or design deficiency.

6.5.2.2.1 Initial Response. When the Owner or the Design Professional notifies the Contractor of a defect, the Contractor will visit the site to review the complaint within five (5) days and shall promptly correct the Work. If the Contractor fails to respond within this time limit, the Owner may correct the defect or malfunction and charge the Contractor for the Work. The Contractor shall give notice in writing to the Owner when corrections have been completed.

6.5.2.2.2 Design Defect or User Abuse. If the Contractor believes that a design defect or user abuse has caused the malfunction or defect, he will notify the Design Professional and the Design Professional will issue a formal decision in his capacity as Design Professional and impartial interpreter of the conditions of the contract. If it is determined the complaint is not the responsibility of the Contractor, the Contractor shall be promptly paid for the cost of the corrective work.

6.5.2.2.3 Emergency Situations. If the condition is an emergency, this will be communicated to the Contractor with the request that no matter what he finds, corrections are to be accomplished immediately. The Contractor shall respond to the notice in emergency situations within twenty-four (24) hours. If the Contractor fails to respond within this time limit, the Owner may correct the defect and charge the Contractor for the Work. If it is determined the complaint is not the responsibility of the Contractor, the Contractor shall be promptly paid for the cost of the corrective work. The Contractor shall give notice in writing to the Owner when corrections have been completed.

6.5.3 Warranty and Guarantee

6.5.3.1 Obligation for Correction of the Work. The Contractor shall within the space of time designated in Notices of Non-Compliant Work and without expense to the Owner, correct, remedy, replace, re-execute, supply omitted work, or remove from the premises all work designated as Non-

Compliant by the Design Professional. The Contractor shall give prompt notice in writing to the Design Professional, with copy to the Owner, upon completion of the supplying of any omitted work or the correction of any work designated as Non-Compliant by the Design Professional. In the absence of said notice, it shall be and is presumed under this Contract that there has been no correction of the Non-Compliant work or supplying of omitted work. If the Contractor does not remove, make good the deficiency, correct, or remedy faulty work, or supply any omitted work within the space of time designated in Notices of Non-Compliant Work without expense to the Owner, the Owner, after ten (10) days' notice in writing to the Contractor, may remove the work, correct the work, remedy the work or supply omitted work at the expense of the Contractor. In case of emergency involving health, safety of property, or safety of life the Owner may proceed at once with correction of the Work without waiving any rights of the Owner. Correction of defective work executed under the plans and specifications or supplying of omitted work whether or not covered by warranty of a subcontractor or materialmen, remains the primary, direct responsibility of the Contractor. The foregoing obligation of the Contractor shall remain in effect until the expiration of the statute of limitations covering the Work.

6.5.3.2 One Year Warranty and Guaranty. As additional security for the fulfillment of such obligation, but in no way limiting the same, the Contractor warrants and guarantees (1) that all work executed under the plans and specifications shall be free from defects of materials or workmanship for a period of one year from the date of the Certificate of Material Completion of the Design Professional, and (2) that for not less than one year from the date of the Certificate of Material Completion of the Design Professional, or for such greater space of time as may have been designated in the specifications, products of manufacturers shall be free from defects of materials and workmanship. Whenever written guaranties or warranties are called for, the Contractor shall furnish the aforesaid for such period of time as may be stipulated. The aforesaid instruments shall be in such form as to permit direct enforcement by the Owner against any subcontractor, materialmen, or manufacturer whose guaranty or warranty is called for. The Contractor further agrees that:

6.5.3.2.1 Jointly and Severally Liable. The Contractor is jointly and severally liable with such subcontractors, materialmen, or manufacturers; and

6.5.3.2.2 Agents of the Contractor. The said subcontractors, materialmen, or manufacturers are agents of the Contractor for purposes of performance under this section, and the Contractor, as principal, ratifies the warranties or guaranties of his aforesaid agents by the filing of the aforesaid instruments with the Owner. The Contractor as principal is liable for the acts or omissions of his agents.

6.5.3.2.3 Service of notice. Service of notice on the Contractor that there has been breach of any warranty or guaranty will be sufficient to invoke the terms of the instrument.

6.5.3.2.4 Bind Subcontractors, etc. The Contractor will bind his subcontractor, materialmen, and manufacturers to the terms of this section.

6.5.3.2.5 Warranties no Limitation. The calling for or the furnishing of written warranties shall in no way limit the contractual obligation of the Contractor to correct the work as set forth in this Part. The remedies stated in this section are in addition to the remedies otherwise available to the Owner, do not exclude such other remedies, and are without prejudice to any other remedies.

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PART 6 – FINAL COMPLETION

6.6.1 Final Completion.

6.6.1.1 Final Completion Defined. Final Completion is the completion of all Work, including completion of all Minor Items and Permitted Incomplete Work as defined in Section 6, Part 1. Final Completion shall be evidenced by the Design Professional's Certificate of Final Completion (Section 7 Forms).

6.6.1.2 When Final Completion Required. Final Completion shall be obtained not later than thirty (30) days after material completion. The Design Professional's Certificate of Final Completion shall not be issued until all Work is completed.

6.6.2 RESERVED.

6.6.3 Effect of Achieving Final Completion. Upon the date when Final Completion is achieved and the Design Professional's Certificate of Final Completion is issued, the following matters are conclusively determined:

6.6.3.1 Project Completion. The Project and the Work are complete.

6.6.3.2 Payment for Final Completion. All amounts withheld from Payment for Material Completion and not credited to the Owner, as set forth in Section 6 Part 4, are payable upon receipt of a final pay request from the Contractor.

6.6.4 Conducting the Inspection for Final Completion. In the event that Permitted Incomplete Work remains after the Interim Inspection for Punchlist Completion, at such time when all such Permitted Incomplete Work has been completed or scheduled for completion, the Contractor shall call for and the Design Professional shall schedule the Final Inspection with the Owner and Contractor. The Design Professional shall conduct the Inspection for Final Completion and shall confirm that all Permitted Incomplete and other Work has been completed. Upon successful completion of the inspection, the Design Professional shall issue the Certificate of Final Completion. Final Payment, including any remaining funds withheld may, upon an application for payment, be paid to the Contractor. Any Final Documents or updates to Final Documents not yet submitted must be submitted with the call for Final Inspection. In the event any item of Permitted Incomplete Work is determined to be incomplete and the date for its completion has passed, the Owner may give the fourteen (14) day notice of failure to complete the Work set forth in Section 6.2.3.

6.6.5 Effect of Failure to Achieve Final Completion. Should Final Completion not be achieved within the time specified, the Owner will issue to the Contractor a fourteen (14) day notice as a final warning to complete the Work. If Final Completion is not achieved by the end of the 14th day from the date of the Notice, the following matters are conclusively determined, subject to any request for extension of time as set forth in Section 6.2.3.3 below:

6.6.5.1 Breach of Covenant of Time. As time is of the essence in the completion of the Work, the Contractor is in breach of the covenant of time and is subject to default.

6.6.5.2 Ineligibility to Bid Upon State Contracts. The Contractor is ineligible to bid upon any contract invitation to bid of the Georgia State Financing and Investment Commission, the Board of Regents of the University System of Georgia or any unit of the University System of Georgia, or the Georgia Department of Administrative Services. In the event a bid has been submitted but the bid award has not been made, the Contractor's ineligibility requires that its bid be rejected.

6.6.5.2.1 Automatic Restoration of Eligibility to Bid. The Contractor's eligibility to bid upon state contracts shall be restored automatically as of the date of achievement of Final Completion as evidenced by the Design Professional's Certificate of Final Completion.

6.6.5.2.2 Application to Reinstate Eligibility to Bid. The Contractor's eligibility to bid upon state contracts may be reinstated upon the following:

(a) A written application to the Owner, not earlier than 18 months after the date of failure to achieve final completion; requesting reinstatement of eligibility, and

(b) The showing of good and just cause why the Contractor's eligibility should be reinstated, or that there is good and just cause to believe that the achievement of Final Completion was impossible to the extent that determination of ineligibility was improvident.

(c) The Owner may, upon written request, permit the Contractor to make a personal presentation upon the application to the Director, GSFIC Construction Division.

6.6.6 Final Payment. Final Payment shall be due 10 days after receipt by the Owner of the application for payment upon achievement and certification of Final Completion. Payment shall be made by a check payable jointly to the Contractor and surety and shall be mailed to the surety. Owner shall process the Final Payment expeditiously as possible in accordance with the certification of the Design Professional, but interest shall not accrue until thirty (30) days have elapsed from receipt, unless error is found in the application or supporting documents.

6.6.6.1 Certification of Contractor. The Contractor shall certify, over his own signature, that the Work provided for by the Contract Documents has been completed under the terms and conditions thereof, and that the entire balance of the contract is due and payable.

6.6.6.2 Supporting Documentation.

6.6.6.2.1 Financial Data. The Contractor shall submit evidence satisfactory to the Design Professional that all payrolls, material bills, and other indebtedness connected with the work have been paid.

6.6.6.2.2 Affidavits and Bonds. The Contractor shall attach copies of the affidavits and bonds set forth in Sections 6.4.2.2.1 and 2 above, execute the payment certification, and forward it directly to the Design Professional.

6.6.7 Effect of Final Payment and Release of Claims. Acceptance of Final Payment for Final Completion by the Contractor shall operate as settlement, waiver, release, discharge and payment in full of all claims against Owner of any nature arising out of the Project.

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SECTION 7 – CONTRACT FORMS

The following forms are referenced in the Agreement for use by the Owner, Construction Professional and Design Professional:

Title	Form Number
PERFORMANCE BOND	GSFIC-AD-101 (10-01-07)
PAYMENT BOND	GSFIC-AD-102 (10-01-07)
APPLICATION FOR PAYMENT	GSFIC-AD-105 (01-03-08)
SAMPLE CHANGE ORDER FORM	GSFIC-AD-109 (10-01-07)
SAMPLE FORCE ACCOUNT AUTHORIZATION	GSFIC-AD-123 (10-01-07)
SUBCONTRACTOR EARLY RETAINAGE RELEASE CERTIFICATE	GSFIC-AD-110 (10-01-07)
MATERIAL COMPLETION CHECKLIST	GSFIC-CS-401 (10-01-07)
CERTIFICATE OF MANUFACTURER (Instructions)	GSFIC-AD-114 (10-01-07)
NON-INFLUENCE AFFIDAVIT	GSFIC-AD-111 (01-25-08)
STATUTORY AFFIDAVIT	GSFIC-AD-112 (01-25-08)
FIVE YEAR BOND ON ROOFS AND WALLS	GSFIC-AD-113 (11-16-07)
BOND TO DISCHARGE CLAIM	GSFIC-AD-118 (10-01-07)
FINAL CERTIFICATION OF COSTS FOR CAPITAL ASSET ACCOUNTING	GSFIC-AC-202 (11-16-07)
DESIGN PROFESSIONAL'S CERTIFICATE OF MATERIAL COMPLETION	GSFIC-AD-116 (10-01-07)
USING AGENCY'S CERTIFICATE FOR MATERIAL COMPLETION	GSFIC-CS-402 (10-01-07)
DESIGN PROFESSIONAL'S CERTIFICATE OF FINAL COMPLETION	GSFIC-AD-119 (10-01-07)

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PERFORMANCE BOND

Project No. and Name:

Construction Professional:

Bond Number:

KNOW ALL MEN BY THESE PRESENTS:

That _____ (Legal Name and Address of the Construction Professional) as principal (hereinafter referred to as ("Principal"), and _____ (Legal Title and Address of Surety) as surety (hereinafter referred to as "Surety"), are held and firmly bound unto the GEORGIA STATE FINANCING AND INVESTMENT COMMISSION as Obligee (hereinafter referred to as "Owner"), in the amount of _____ DOLLARS ($ _____), to which payment Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the above bounden Principal has entered into a contract with the Owner bearing date of _____ for: _____ (Insert Name of Project) in accordance with drawings and specifications prepared by: _____ (Full Name of Design Professional), which said contract is incorporated herein by reference and made a part hereof, and is hereinafter referred to as the Contract.

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if the Principal shall promptly and faithfully perform and comply with the terms and conditions of said contract; and shall indemnify and save harmless the Owner against and from all cost, expenses, damages, injury or loss to which said Owner may be subjected by reason of any wrongdoing, including patent infringement, misconduct, want of care or skill, default or failure of performance on the part of said Principal, his agents, subcontractors or employees, in the execution or performance of said contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

1 The said Surety to this bond, for value received, hereby stipulates and agrees that no change or changes, extension of time or extensions of time, alteration or alterations or addition or additions to the terms of the contract or to the work to be performed thereunder, or the specifications or drawings accompanying same, or the exercise of the Owner's right to perform work with separate contractors or to correct work pursuant to the terms of the Contract, shall in any wise affect its obligation on this bond, and it does hereby waive notice of any such change or changes, extension of time or extensions of time, alteration or alterations or addition or additions to the terms of the contract or to the Work or to the specifications or drawings. In addition, the Surety to this bond, for value received, hereby agrees to the provisions of Section 1 Part 5 Penal Amount of Bonds, State Law for increases in the penal amount of this bond and waives notice from the Owner of any such changes.

2 If pursuant to the Contract Documents the Principal shall be declared in default by the Owner under the aforesaid Contract, the Surety shall promptly perform this bond agreement in accordance with its terms and conditions. It shall be the duty of the Surety to give an unequivocal notice in writing to the Owner, within twenty-five (25) days after receipt of a declaration of default, of the Surety's election to either remedy the default or defaults promptly or to perform the Contract promptly, time being of the essence. In said notice of election, the Surety shall indicate the date on which the remedy or performance will commence, and it shall then be the duty of the Surety to give prompt notice in writing to the Owner immediately upon completion of (a) the remedy and/or correction of each default, (b) the remedy and/or correction or each item of condemned work, (c) the furnishing of each omitted item of work, and (d) the performance of the contract. The Surety shall not assert its Principal as justification for its failure to give notice of election or for its failure to promptly remedy the default or defaults or perform the Contract.

3 Supplementary to and in addition to the foregoing, whenever the Owner shall notify the Surety that the Owner has notice that the Principal has failed to pay any subcontractor, materialman, or laborer for labor or materials certified by the Principal as having been paid for by the Principal in accordance with said Contract, which said laborer or materials have been included in an application for payment and certified by the Design Professional for payment and paid for by the Owner, the Surety shall, within 20 days of receipt of such notice, cause to be paid any unpaid amounts for such labor and materials.

4 It is expressly agreed by the Principal and the Surety that the Owner, if he desires to do so, is at liberty to make inquiries at any time of subcontractors, laborers, materialmen, or other parties concerning the status of payments for labor, materials, or services furnished in the prosecution of the work.

5 No right of action shall accrue on this bond to or for the use of any person or corporation other than the Owner named herein or the legal successors of the Owner.

6 For the purposes of this bond, the name and address of the Authorized State of Georgia Licensed Agent to whom correspondence and telecommunications may be addressed and/or with whom business concerning this bond may be conducted will be as follows:

Name: Telephone:

Address:

City: State: Zip Code:

7 Further, this bond shall be the Performance Bond furnished under O.C.G.A. §§ 13-10-2, 13-10-20, 13-10-40 and 13-10-60 and shall be subject to increase in the penal amount of the bond pursuant to such statutes and the provisions of Section 1 Part 5 Penal Amount of Bonds, State Law of the Contract.

SIGNED AND SEALED THIS _____ DAY OF _____, 20_____.

ATTEST (Seal)

_____
(Name of Principal)

_____ By_____
Secretary (Note 1) President

(Seal)

_____
(Name of Surety) (Note 2)

By: _____
_____ (Title)
Resident Georgia Agent *

Note 1. Please apply seal of Corporation over Secretary's Signature.
Note 2. Please apply seal of Surety and arrange for countersignature by a "Resident Georgia Agent" of Surety in order to comply with surety regulations of Georgia.
(*) Attach Power of Attorney

PAYMENT BOND

Project No. and Name:

Construction Professional:

Bond Number:

KNOW ALL MEN BY THESE PRESENTS:

That _____ (Legal Title and Address of the Construction Professional) as Principal (hereinafter referred to as the "Principal") and _____ (Legal Name and Address of the Surety) as Surety (hereinafter referred to as "Surety", are held and firmly bound unto the GEORGIA STATE FINANCING AND INVESTMENT COMMISSION. as Obligee (hereinafter referred to as "Owner") for the use and benefit of claimants defined, hereinafter in the amount of: _____DOLLARS ($_____) to which payment Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns jointly and severally, firmly by these presents.

WHEREAS, the above bounden Principal has entered into a contract with Owner dated _____ for _____(Insert Name of Project) in accordance with the drawings and specifications prepared by _____(Full Name of Design Professional), which contract is incorporated herein by reference and made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Principal shall promptly make payment to all claimants as hereinafter defined, for all labor and materials supplied in the prosecution of the work provided for in said Contract, then this obligation shall be void, otherwise it shall remain in full force and effect subject, however, to the following conditions:

(1) The said Surety to this bond, for value received, hereby stipulates and agrees that no change or changes, extension of time or extensions of time, alteration or alterations or addition or additions to the terms of the contract or to the work to be performed thereunder, or the specifications or drawings accompanying same, or the exercise of the Owner's right to perform work with separate contractors or to correct work pursuant to the terms of the Contract, shall in any wise affect its obligation on this bond, and it does hereby waive notice of any such change or changes, extension of time or extensions of time, alteration or alterations or addition or additions to the terms of the contract or to the Work or to the specifications or drawings. In addition, the Surety to this bond, for value received, hereby agrees to the provisions of Section 1 Part 5 Penal Amount of Bonds, State Law for increases in the penal amount of this bond and waives notice from the Owner of any such changes.

(2) A claimant is defined as any subcontractor and any person supplying labor, materials, machinery, or equipment in the prosecution of the work provided for in said contract.

(3) Every person entitled to the protection hereunder and who has not been paid in full for labor or materials furnished in the prosecution of the work referred to in said bond before the expiration of a period of ninety (90) days after the day on which the last of the labor was done or performed by him, or materials or equipment or machinery was furnished or supplied by him for which claim is made, shall have the right to sue on such payment bond for the amount, or the balance thereof, unpaid at the time of the commencement of such action and to prosecute such action to final execution and judgment for the sum or sums due him, provided, however, that any person having direct contractual relationship with a subcontractor, but no contractual relationship express or implied with the Principal furnishing said payment bond shall have (a) given written notice to said Principal within ninety (90) days from the day on which such person did or performed the last of the labor, or furnished the last of the materials or machinery or equipment for which such claim is made stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished or supplied or for whom the labor was performed or done; and (b) if the Principal has filed a Notice of Commencement with the Clerk of the Superior Court in the county in which the Project is located pursuant to O.C.G.A. § 13-10-62, given to said contractor a written Notice to Contractor within 30 days from the filing of the Notice of Commencement or 30 days following the first delivery of labor, materials, machinery or equipment, whichever is later, setting forth:

A) The name, address, and telephone number of the person providing labor, material, machinery, or equipment; the name and address of each person at whose instance the labor, material, machinery or equipment is being furnished;
B) The name and the location of the public work; and
C) A description of the labor, material, machinery, or equipment being provided and, if known, the contract price or anticipated value of the labor, material, machinery, or equipment to be provided or the amount claimed to be due, if any.

It is provided further that nothing contained herein shall limit the right of action to said 90-day period. Notice may be served by the depositing of a notice, registered mail, postage paid, duly addressed to the Principal at any place he maintains an office or conducts his business, or his residence, in any post office or branch post office or any letter box under the control of the Post Office Department or notice may be served in any manner in which the sheriffs of Georgia are authorized by law to serve summons or process. Every suit instituted under this section shall be brought in the name of the claimant without Owner being made a party thereof. The official who has custody of said bond is authorized and directed to furnish, to any person making application thereof who submits an affidavit that he has supplied labor or materials for such work and payment therefore has not been made, or that he is being sued on any such bond, a copy of such bond and the contract for which it was given, certified, by the official who has custody of said bond and contract shall be admitted in evidence without further proof. Applicants shall pay for such certified statements and such fees as the official fixes to cover the cost of preparation thereof, but in no case shall the fixed fee exceed the fees that the clerks of the superior courts are permitted to charge for similar copies.

(4) No action can be instituted on this bond after one year from the date of the final certificate of the Design Professional.

(5) Further, this bond shall be the Payment Bond furnished in compliance with O.C.G.A. §§ 13-10-2, 13-10-60, 13-10-40 and 13-10-60 and shall be subject to increase in the penal amount of the bond pursuant to such statutes and Section 1 Part 5 Penal Amount of Bonds, State Law of the Contract.

(6) For the purposes of this bond, the name and address of the Authorized State of Georgia Licensed Agent to whom correspondence and telecommunications may be addressed and/or with whom business concerning this bond may be conducted will be as follows:

Name: Telephone:

Address:

City: State: Zip Code:

SIGNED AND SEALED THIS _____ DAY OF _____, 20_____.

ATTEST (Seal)

_____
(Name of Principal)

_____ By_____
Secretary (Note 1) President

(Seal)

_____
(Name of Surety) (Note 2)

By: _____
_____ (Title)
Resident Georgia Agent *

Note 1. Please apply seal of Corporation over Secretary's Signature.
Note 2. Please apply seal of Surety and arrange for countersignature by a "Resident Georgia Agent" of Surety in order to comply with surety regulations of Georgia.

(*) Attach Power of Attorney

APPLICATION FOR PAYMENT No. _____ Dated: _____

Project No. and Name: _____

CERTIFICATE OF THE CONSTRUCTION PROFESSIONAL

To the best of my knowledge and belief, I certify that all items, units, quantities, and prices of work and material shown on this Application for payment are correct; that all work has been performed and materials supplied in full accordance with the terms and conditions of the Contract Documents and authorized changes thereto; and that the following is a true and correct statement of the contract account up to and including the last day of the period covered by this Application and that no part of the "amount due this Application" has been received:

	Base Contract, PreCon, CCO's, GMP (less CO's)	Change Orders	Total	(GSFIC use only)
(a) Authorized Amounts			$0.00	
(b) Preconstruction Services Earned			$0.00	
(c) Construction Services Earned to Date			$0.00	
(d) Value of Materials Stored on Site				
(e) Total construction earned [(c) + (d)]			$0.00	
(f) Construction Retainage [10% of (e) or attach worksheet]				
(g) Total construction earned less retainage [(e) – (f)]			$0.00	
(h) Total previously approved				
(i) Total amount due this **APPLICATION** [(b) + (g) - (h)]			**$0.00**	
(j) Percentage of construction work complete [Authorized work excluding stored materials as of Application date]				
(k) The construction work is estimated to be _____ schedule by				

Attached to this Application for Payment are schedules and backup materials affirming payments for materials, labor, equipment, payments made to subcontractors and stored materials. I certify all claims outstanding against the Construction Professional in the performance of said contract have been paid in full except such outstanding claims as are listed on the attached sheet containing any claim that is unpaid or disputed or to which the Construction Professional has or will assert any defense. I further certify that all of the materials indicated on this Application for Payment as being stored on the Site have been purchased, delivered, and are presently stored on the Site. Title to same is, upon payment of this statement, vested in the Owner. Furthermore, the undersigned Construction Professional assumes full responsibility for the existence, protection, and, if necessary, replacement of the above-mentioned materials until the completion of this contract.

Construction Professional: _____ [Name of Firm]

By: _____ Title: _____ Date: _____

STATEMENT OF THE CONTRACT COMPLIANCE SPECIALIST

I have checked this Application for Payment and, to the best of my knowledge and belief, the statement of work performed and statement of materials stored on site by the Construction Professional are supported by my observations.

Contract Compliance Specialist: _____ Date: _____

CERTIFICATE OF THE DESIGN PROFESSIONAL

I certify that I have verified this Application for Payment and, to the best of my knowledge and belief, it is a true and correct statement of work performed and statement of materials stored on site by the Construction Professional and that the certified statement of this account and the amount due is correct. I further certify that all work has been performed and materials have been supplied in full accordance with the terms and conditions of the Contract Documents and authorized change orders.

Design Professional: _____

By: _____ Title: _____ Date: _____

STATEMENT OF THE PROJECT MANAGER or EXECUTIVE ADMINISTRATOR

I have checked this Application for Payment and, to the best of my knowledge and belief, the statement of work performed and statement of materials stored on site by the Contractor are supported by my observations.

Project Manager / Executive Administrator: _____

Dept ID: _____ Fund Source: _____ Date: _____

Acct #: _____ Payable Amount: _____

Retainage Calculation Worksheet

Instructions: Attach to Application for Payment if Line (f) Retainage is not entered as 10% of Line (e)

Note: Cases 1-3 apply to GSFIC Design-Bid-Build; CM/GC and Design-Build Contracts;

Case 4 applies to GSFIC Small Construction and other Contracts

Case 1: Retainage at 10% (with credits for Early Subcontractor Retainage Release)

1. Total Amount Earned [Payment Application Line (e)] $0.00

2. 10% of Payment Application Line (e) $0.00

3. List Early Release of Subcontractor Retainages approved to date (Form GSFIC-AD-110):

Subcontractor	Amount
Total:	$0.00

4. Adjusted Retainage (Line 2 minus Line 3)..... $0.00

Case 2: Retainage converted to a Lump Sum

1. Amount withheld as retainage on previous Application.....

2. Approved date of conversion of Line 1 to Lump Sum.....

Case 3: Retainage previously converted to a Lump Sum with new additional subcontractor retainages paid:

1. Amount previously approved as Lump Sum.....

2. List Additional Early Release of Subcontractor Retainages approved (Form GSFIC-AD-110):

Subcontractor	Amount
Total:	$0.00

3. Adjusted Retainage (Line 1 minus Line 2)..... $0.00

Case 4: Retainage converted to other than 10%

1. Amount withheld as retainage.....

Explanation:

SAMPLE CHANGE ORDER FORM (Prepared by Owner)

[Project No. and Name]

Change Order # __

Change Order under Incumbrance Record __

Form Issuance Date:_____

1. Submission of this change order for consideration was authorized by a request from the Owner under Incumbrance Record __. The following authorizations apply:

   Authorizations under Incumbrance Record__

   1) [Force Account]
   2) [Lump Sum]
   3) [Consent]
   4) [Consent for Acceptance]
   5) [Post Bid Addendum]
   6) [Unit Price]
   7) [Credit for Acceptance]

2. The changes hereinafter described are applicable to the contract for the construction of Project [Project No. and Name] executed by and between the Owner, and [Construction Professional], dated _____.

DESCRIPTION:

Items that are attached to this change order:

Item:	Description:	Dated:
1)		
2)		

Pricing Method: *1) [Force Account]*
2) [Lump Sum]
3) [Unit Price]

Type of Change Order: *[In Full] [In Part]*

This change order is deemed necessary and originated with the *[Construction Professional] [Design Professional] [Owner/Using Agency].*

Reason for Change:

3. We have verified the fact that all quantities shown are accurate and do not exceed actual requirements. We have verified the fact that all prices are fair and equitable and do not exceed current costs for like services or materials.

4. **The Construction Professional shall be allowed __ additional calendar days for Material Completion.**

5. **The Contract shall be** *[increased] [decreased] [unchanged]* **by $_____ on account of this change.**

6. The payment and extension of time (if any) provided by this change order constitutes compensation in full on behalf of the Construction Professional and its Trade Contractors and Suppliers for all costs and markups, directly and indirectly attributable to the changes ordered herein, for all delays related thereto and for performance of changes within the time stated.

RECOMMENDED FOR OWNER'S ACCEPTANCE:
Design Professional: _____

By: _____ Date: _____

APPROVED AND AGREED:
Construction Professional: _____

By: _____ Date: _____

AGREED:

Georgia State Financing and Investment Commission
Owner

By: _____ Date: _____

SAMPLE FORCE ACCOUNT AUTHORIZATION FORM (Prepared by Owner)

[Project No. and Name] *Incumbrance Record ___*

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
CONSTRUCTION DIVISION
Second Floor, 270 Washington Street
Atlanta, Georgia 30334

404-463-5600 Fax: 404-463-5611

[Project No. and Name]

Incumbrance Record ___
Authorization to Commence Work Under Force Account

Date Issued: _____, 20__
To: Construction Professional:

_____

Design Professional:

_____

Contract Compliance Specialist:

_____

1. The CONSTRUCTION PROFESSIONAL is authorized to commence the following scope of work under Force Account:
   DESCRIPTION:

_____

2. Pricing Method: Force Account - By expenditures allowed under Section 3 Part 4. Expenditures must be recorded on a daily basis. Costs may not exceed the Stipulated Maximum Sum. Any increase in the Stipulated Maximum Sum shall be requested by the General Contractor to the Owner. **The STIPULATED MAXIMUM SUM is $_____**
3. Change Requested By: _____
4. Reason for Change: _____
5. The DESIGN PROFESSIONAL is to provide items indicated below:

   ☐ Provide to the Construction Professional (by _____,20__) a complete description of scope for the change which will reference and be identified by Incumbrance Record ____.

   ☐ Provide to GSFIC written notice via separate correspondence (by _____,20__ if an increase in the Design Professional's fee is warranted.

   ☐ Include with the description of scope plans, specifications and any other supporting documentation needed to fully illustrate and further describe the scope of the change.

   ☐ Provide to GSFIC (by _____, 20__), a copy of the description of scope along with the Design Professional's estimate of any time and cost impact of the change.

6. Upon completion of the Force Account work, the CONSTRUCTION PROFESSIONAL is to provide items indicated below:

   ☐Prepare pricing within fourteen (14) calendar days of completion of the work, providing a complete cost breakdown in the format described in Section 3 Part 4 which will also reference the Design Professional's description of scope for the change and be identified by Incumbrance Record ___.

   ☐Submit pricing (4 copies) with one copy sent directly to the Design Professional, the CCS and the GSFIC Project Manager, (one copy will be retained by the Construction Professional).

   ☐If the Construction Professional requests a time extension submit the relevant requirements of Section 3 Part 4.

7. A lump sum Change Order will be processed to incorporate this Force Account authorization into the Construction Agreement at the completion of the work. An interim (in-part) lump sum Change Order may be processed if the Construction Professional requests payment for partial work completed under Force Account authorization.
8. This Force Account authorization is issued by the Owner.

_____ *(GSFIC Project Manager)*

IMPORTANT: Note that "time is of the essence". Please provide the requested information, by no later than the dates indicated above. If an extension of a date is necessary, request it in writing (hard copy or electronically). Failure to provide information by the time requested may cause adverse impact on project progress and may cause late project delivery. Refer to the General Requirements of the contract for further explanation of change order requirements.

If there is any disagreement with the validity, description, or details of this request please contact this office immediately.

SUBCONTRACTOR EARLY RETAINAGE RELEASE CERTIFICATE

Project No. and Name: _____

_____

Construction Professional: _____

Design Professional: _____

Subcontractor: _____

TO: Georgia State Financing and Investment Commission.
270 Washington Street, 2nd Floor
Atlanta, Georgia 30334

1. This is to certify that the Subcontractor's work is one hundred percent complete for _____*(Identify subcontract scope, contract document, etc..)*. Subcontractor retainage is due in accordance with the Contract Documents. The total amount of retainage now due is $ _____.

2. The Subcontractor hereby certifies that all work required under the above contract has been performed in accordance with the terms thereof, that all materialmen, subcontractors, mechanics, and laborers have been paid and satisfied in full, and that there are no outstanding claims of any character (including disputed claims or any claims to which the subcontractor has or will assert any defense) arising out of the performance of the contract which have not been paid and satisfied in full except withheld retainage and items as listed herein below, which exceptions apply only to the release in Paragraph 5, below: _____ *[Enter: "None" or List here or attach as Exhibit A.]*

3. The Subcontractor further certifies that to the best of his knowledge and belief there are no unsatisfied claims for damages resulting from injury or death to any employees, subcontractors, or the public at large arising out of the performance of the contract, or any suits or claims for any other damage of any kind, nature, or description which might constitute a claim or lien upon the property of the Owner.

4. The Subcontractor further certifies he has no knowledge of the exertion of any influence or the attempted exertion of any influence on the firm on behalf of which this Certificate is made, in any way, manner, or form in the purchase of materials, equipment, or other items involved in construction, manufacture, or employment of labor under the aforesaid contract by any employee, officer, or agent of the Owner, or any person connected with the State Government of Georgia in any way whatsoever.

5. The Subcontractor ☐has ☐has not (Check One) received final payment in full settlement of all claims against the Owner and Construction Professional arising under or by virtue the contract. Acceptance of such payment is acknowledged as a release of the Owner and Construction Professional from any and all claims arising under or by virtue of the contract except as listed in Paragraph 2 above.

7. Payments pursuant to this certificate shall in no way diminish, change, alter or affect the rights of the Owner under the Contract Documents.

_____
[Subcontractor]

By: _____(Name and Title) Date: _____

_____
[Construction Professional]

By: _____(Name and Title) Date: _____

_____
[Design Professional]

By: _____(Name and Title) Date: _____

GSFIC Use Only:
Reviewed: _____ Date: _____

CONSTRUCTION PROFESSIONAL'S

MATERIAL COMPLETION CHECKLIST

Project No. and Name: _____

_____

Construction Professional: _____

This Checklist completed by the undersigned is provided as a guide to assist in the compilation of documents required for Material Completion. Any exceptions or incomplete items shall be identified and explained in Part D. Refer to the executed contract documents for complete details on Material Completion Requirements and additional requirements associated with services of Commissioning Authority and Executive Administrator if applicable.

The Construction Professional affirms completion, transmittal or provision of the following Material Completion contract requirements:

Part A - Submittals and Requirements prior to Notice of Readiness for Inspection for Material Completion:

- ☐ 1. Correction of all non-compliant or incomplete work.
- ☐ 2. Preparation of an initial punch list of Minor Items and Permitted Incomplete Work.
- ☐ 3. Completion of all coordination and work requirements associated with Commissioning Authority (if applicable).
- ☐ 4. Copy of the initial test and balance report on HVAC systems.
- ☐ 5. Copy of the facility operation and maintenance instructions and any other documents specified in Division 1.
- ☐ 6. Certificate of Contractor that all building systems are operational.
- ☐ 7. All permits and certificates for operation from applicable regulatory agencies as required by the Contract Documents.

Part B - Issuance of Notice of Readiness for Inspection for Material Completion.

- ☐ 1. Issuance of Notice.

Part C - Final Documents [Provided by Construction Professional in three ring binders]:

- ☐ 1. All documents required by the specifications.
- ☐ 2. All warranties and guarantees required by the Contract Documents.
- ☐ 3. Non-Influence Affidavit.
- ☐ 4. Statutory Affidavit.
- ☐ 5. Bond to Discharge Claim (if applicable).
- ☐ 6. Five-Year Bond for Roofs and Walls.
- ☐ 7. Receipts verifying transmittal of Marked-up Contract Documents.

8. Receipts verifying transmittal or provision of:
   - ☐ a. Proper written instructions on operation and maintenance of all mechanical and electrical equipment.
   - ☐ b. Training to the Using Agency in the operation and maintenance of all mechanical and electrical systems.
   - ☐ c. Complete brochures and data as prepared and published by the manufacturers of mechanical or electrical equipment or apparatus installed that requires operation or maintenance after occupancy.
   - ☐ d. Operation and Maintenance Manuals.

☐ 9. Certificates of Manufacturers for Major Components.

☐ 10. Final Certification of Costs.

☐ 11. Key Schedule and Receipt verifying transmittal of keys.

☐ 12. [Other deliverables specified in Contract Documents] _____.

Part D - Exceptions (State Paragraph reference and explanation):

_____

This Checklist for Material Completion is executed this _____ day of _____, 20___.

By: _____

Title: _____
Authorized Representative of
Construction Professional

Reviewed and Received by:

CONSTRUCTION DIVISION, GSFIC

By: _____

Title: _____

Firm: _____

EXECUTIVE ADMINISTRATOR
(if applicable)

By: _____

Title: _____

CERTIFICATE OF MANUFACTURER *(Instructions)*

*'INSTRUCTIONS FOR PREPARATION OF CERTIFICATE: To be acceptable, the certificate must be prepared in the form indicated by this example on the official letterhead of the manufacturer. No portions of the certificate may be omitted. Attached is a copy of the Contract provision under which the certificate is required. The Owner requires only one copy of the certificate. If equipment of a manufacturer is not installed in strict compliance with the recommendations of the manufacturer or if in the design of the work the equipment is not applied in strict compliance with the recommendations of the manufacturer, a letter from the manufacturer should be forwarded to the Construction Professional [with copies to the Design Professional and the Owner] setting forth a list of the deviations from the recommendations of the manufacturer and stating what remains to be done in order to bring the work into strict compliance with the recommendations of the manufacturer. Prior to calling upon the representative of the manufacturer for performance of the services necessary to enable him to execute a certificate in accordance with this specimen, it is the obligation of the Construction Professional to have installed the work in strict compliance with the recommendations of the manufacturer, and it is likewise the obligation of the Construction Professional to have put the equipment in good operating condition in absolute and final readiness for the **start-up, testing,** and **placing into operation** as defined below by the representative of the manufacturer.*

Definitions:
Start-up is defined as putting the equipment into action.
Testing is defined as performing testing as stipulated in the Contract Documents
Placing into operation is defined as operating the equipment for a sufficient period of time under normal operating conditions for determination to be made it is performing properly.

[*Company Letterhead*]

Date: _____

To: GEORGIA STATE FINANCING AND INVESTMENT COMMISSION

Re: Certificate of *[name of Manufacturer]* that equipment or components furnished have been installed in strict compliance with manufacturer's recommendations and is operating properly at _____*(Project No. and Name).*

1. We certify through our duly authorized and acting agent that the following item(s) furnished by us to the referenced Project were started up, tested, and placed in operation by our authorized field representative on _____*[enter the date on which the field representative performed the start-up, test, and placing into operation]* and is operating properly:

   [*List the items furnished to the job. Show name of manufacturer and catalogue numbers*]
   _____
   _____
   _____

2. We certify further that the aforesaid equipment was installed in strict compliance with our recommendations as published by us in the following document (s):

   [Insert the date, name or other positive means of identifying the exact document(s) in which the recommendations for installation and use of the item or items are published.] [Date must be shown]

3. Copies of the aforesaid documents are attached hereto.

This _____ day of_____, 20____

By: _____ _____
Authorized Representative of Manufacturer Name of Firm

NON-INFLUENCE AFFIDAVIT

Project No. and Name: _____

_____

_____

Construction Professional: _____

STATE OF GEORGIA;
COUNTY OF _____:

I do solemnly swear on my oath that, as to the Construction Agreement dated _____, 20__, between _____ (Name of Construction Professional) and the Georgia State Financing and Investment Commission., I have no knowledge of the exertion of any influence or the attempted exertion of any influence on the firm on behalf of which this affidavit is made, in any way, manner, or form in the purchase of materials, equipment, or other items involved in construction, manufacture, or employment of labor under the aforesaid Contract by any employee, officer, or agent of the Owner, or any person connected with the State Government of Georgia in any way whatsoever.

This Affidavit is executed by the Construction Professional this _____ day of _____, 20__.

_____
(Legal Signature)

_____
(Title)

_____
(Name of Construction Professional firm)

SUBSCRIBED AND SWORN
BEFORE ME ON THIS THE

_____ DAY OF _____, 20__

_____ [NOTARY SEAL]
Notary Public

My Commission Expires: _____

STATUTORY AFFIDAVIT

Project No. and Name: _____

_____

_____

Construction Professional: _____

STATE OF GEORGIA;
COUNTY OF _____:

KNOW ALL MEN BY THESE PRESENTS:

In reference to the Construction Agreement dated _____, 20__, between _____ (Name of Construction Professional) and the Georgia State Financing and Investment Commission, the Construction Professional certifies as follows:

1. All work required under the Construction Agreement has been performed in accordance with the terms thereof except as listed on attached Schedule A. ☐ *Check if Schedule A is attached*
2. All materialmen, Trade Contractors, mechanics, and laborers have been paid and satisfied in full except as listed on attached Schedule B. ☐ *Check if Schedule B is attached*
3. There are no outstanding claims of any character [including disputed claims or any claims to which the Construction Professional has or will assert any defense] arising out of the performance of the Construction Agreement that have not been paid and satisfied in full except as listed on attached Schedule C.
   ☐ *Check if Schedule C is attached*
4. To the best of his knowledge and belief there are no unsatisfied claims for damages resulting from injury or death to any employees, Trade Contractors, or the public at large arising out of the performance of the contract, or any suits or claims for any other damage of any kind, nature, or description except as listed on attached Schedule D.
   ☐ *Check if Schedule D is attached*

The undersigned makes this affidavit for the purpose of receiving payment for material completion; or, in the case of final payment for full settlement of all claims against the Owner arising under or by virtue of the Construction Agreement except as stated above. Acceptance of such payment is acknowledged as a release of the Owner from any and all claims arising under or by virtue of the Agreement except as stated above.

This Affidavit is executed by the Construction Professional this _____ day of _____, 20__.

_____, _____ (Title)
(Legal Signature)

_____(Name of Construction Professional firm)

SUBSCRIBED AND SWORN
BEFORE ME ON THIS THE

_____ DAY OF _____, 20__

_____ [NOTARY SEAL]
Notary Public

My Commission Expires: _____

FIVE YEAR BOND ON ROOFS AND WALLS

Project No. and Name: _____

_____

_____

Construction Professional: _____

Surety: _____

STATE OF GEORGIA;
COUNTY OF :

Firmly Bound. Know all men by these presents, that we _____ (CONSTRUCTION PROFESSIONAL) as Principal, and _____, as Surety, are held and firmly bound unto the GEORGIA STATE FINANCING AND INVESTMENT COMMISSION (Owner), in the sum of _____ Dollars ($ _____) for the payment of which will and truly to be made and done, we bind ourselves, our executors and administrators, our successors and assigns, jointly and severally, by these presents.

Condition of Obligation. The condition of the above obligation is such that WHEREAS CONSTRUCTION PROFESSIONAL has entered into a Contract with Owner dated _____ for construction of Project No._____.

Warranty. WHEREAS, the said CONSTRUCTION PROFESSIONAL warrants with respect to the said work that for a period of five years from the date of the execution of Certificate of Material Completion by the Design Professional, the roofs of the building (or buildings) and roofs of covered passages, including but not limited to roof decking; deck sheathing; material used as a roof base or insulation over which roof is applied; roofing materials; promenade decks or any other work on the surface of the roof; flashing; base flashing; counter flashing; metal work, gravel stops; or roof expansion joints shall be absolutely watertight and free from all leaks. At no expense to the Owner, the CONSTRUCTION PROFESSIONAL will make repairs to any defects that may develop in the work including but not limited to: blisters, exposed felts, ridges, wrinkles, splits, warped insulation, and loose flashing, in a manner compatible to the system and acceptable under industry standards and in accordance with the construction specifications. The CONSTRUCTION PROFESSIONAL also warrants that for the same five-year period the walls of the building (or buildings) including but not limited to: vertical and/or horizontal expansion joints, below and/or above grade waterproofing, below and/or above grade damp-proofing, thru-wall flashing, damp course flashing and waterproofing of joints at openings in walls including but not limited to door perimeters, window perimeters, vents and pipe openings shall be absolutely watertight and free from all leaks, seepage or dampness, and that he shall, at no expense to the Owner, make repairs to any defects that may develop in the work in a manner compatible to the system and acceptable under industry standards and in accordance with the construction specifications, Provided, however: That the following are excluded from the warranty:

(a) Defects or failures resulting from abuse by the Owner.

(b) Defects in design that the said **CONSTRUCTION PROFESSIONAL** shall have brought to the attention of the Owner in writing prior to installation of the work, except, however, that the **CONSTRUCTION PROFESSIONAL** shall not be responsible, insofar as liability under this bond is concerned, for bringing to the attention of the Owner defects in design involving failure of:
   (1) Structural Frame
   (2) Load bearing walls
   (3) Foundations

   nor shall the **CONSTRUCTION PROFESSIONAL** be responsible for correction of leaks resulting from said failure.

(c) Damage caused by fire, tornado, hail, hurricane, acts of God, wars, riots, or civil commotion.

(d) The CONSTRUCTION PROFESSIONAL is not an insurer nor is he a guarantor of the suitability of adequacy of design. Any other provisions of this bond to the contrary notwithstanding, the CONSTRUCTION PROFESSIONAL shall not be required to remedy any unsuitable or inadequate design.

Leaks or Defect. WHEREAS the said CONSTRUCTION PROFESSIONAL agrees that should any leaks or defects occur in the roofs or walls of the said (Name and Number of Project) the said CONSTRUCTION PROFESSIONAL will promptly remedy the said leaks or defects and pay for any damage to other work of said Project resulting therefrom, except, however, that when this instrument is executed by a Trade Contractor this Contract, shall, insofar as the Trade Contractor is concerned, extend only to the work executed by said Trade Contractor.

Effective Date. The effective date of the Five Year Bond on Roofs and Walls shall be the Material Completion Date of the Project which is _____day of _____, 20__ *(Insert Material Completion Date).*

Full Force and Effect. NOW, THEREFORE, the condition of this obligation is such that if the CONSTRUCTION PROFESSIONAL shall in all things promptly and faithfully perform and comply with the terms and conditions hereinbefore set forth, then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

SIGNED AND SEALED THIS _____ DAY OF _____, 20_____.

ATTEST (Seal)

_____
(Name of Principal)

_____
Secretary (Note 1)

By_____
President

(Seal)

_____
(Name of Surety) (Note 2)

By: _____
_____ (Title)
Resident Georgia Agent *

Note 1. Please apply seal of Corporation over Secretary's Signature.
Note 2. Please apply seal of Surety and arrange for countersignature by a "Resident Georgia Agent" of Surety in order to comply with surety regulations of Georgia.

(*) Attach Power of Attorney

BOND TO DISCHARGE CLAIM

Project No. and Name:

Construction Professional:

WHEREAS, _____ (hereinafter referred to as "Claimant") has filed a claim against _____ (the Construction Professional, hereinafter referred to as "Principal") on the above-referenced Project,

WHEREAS, the undersigned Principal and Surety dispute the Claimant's entitlement to all or part of the claim and expressly reserve all rights and defenses available at law in connection therewith;

WHEREAS, _____ as Principal and _____ as Surety, desire to continue to receiving payments from the Owner (Georgia State Financing and Investment Commission) for work done on the above referenced project,

NOW THEREFORE, in consideration of these premises, the undersigned Principal and Surety do hold themselves firmly bond unto _____ as Claimant, in the total amount of _____ dollars ($ _____), representing 200% the amount of the claim.

The condition of this bond is such that should the undersigned Principal or Surety pay to the Claimant the sum that may be found to be due to the Claimant upon the trial of any action that may be filed by said Claimant, or if Principal or Surety pay to the Claimant a sum agreeable to Claimant and Claimant accepts such payment, then this Bond shall be void; otherwise to remain in full force and effect.

SIGNED AND SEALED THIS _____ DAY OF _____, 20_____.

ATTEST (Seal)

_____
(Name of Principal)

_____
Secretary (Note 1)

By_____
President

(Seal)

_____
(Name of Surety) (Note 2)

By: _____
_____ (Title)
Resident Georgia Agent *

Note 1. Please apply seal of Corporation over Secretary's Signature.
Note 2. Please apply seal of Surety and arrange for countersignature by a "Resident Georgia Agent" of Surety in order to comply with surety regulations of Georgia.

(*) Attach Power of Attorney

FINAL CERTIFICATION OF COSTS FOR CAPITAL ASSET ACCOUNTING

Project No. and Name: _____

_____

_____

Construction Professional: _____

Design Professional: _____

The Construction Professional issues this Certificate of Costs for Capital Asset Accounting of the Project to the GEORGIA STATE FINANCING AND INVESTMENT COMMISSION and certifies as follows.

The following accounting of costs is submitted as follows, with the breakdown of costs as specified in the Application for Payment for Material Completion attached hereto, for the purposes of capital asset accounting pursuant to GASB-34 Accounting Statements: *(Note: Costs of all change orders are apportioned and included in each item below)*

1.	**BUILDING AND BUILDING IMPROVEMENTS:**	**$0.00**
2.	**INFRASTRUCTURE:**	**$0.00**
3.	**FURNISHINGS AND EQUIPMENT:**	**$0.00**
	TOTAL:	**$0.00**

CERTIFICATE OF THE CONSTRUCTION PROFESSIONAL

I certify to the best of my knowledge and belief that all of the amounts set forth on this Certificate are true and correct and are supported by the financial records for this project on file with the Construction Professional.

This Certificate is executed by the Construction Professional this _____day of _____, 20__.

_____

(Construction Professional)

By: _____

Title:_____

CERTIFICATE OF THE DESIGN PROFESSIONAL

I certify to the best of my knowledge, information and belief that the amounts certified by the Construction Professional are consistent with the estimates provided in my final Statement of Probable Cost for the Project; that the Building Improvement contains a footprint based upon a line 5 feet outside the building structure) of _____ square feet, a total of _____ gross square feet, and contains _____ floors (including basements). The building fire protection system is _____ (include type of system). The Certificate of Occupancy was issued on _____. I further certify that the design intent for this project is that the Building and Building Improvements are of Building Construction Class _____ and ISO Occupancy Type(s) _____ and have an expected useful life of _____ years from the date of this Certificate, and that my observations of the construction confirm these expectations.

This Certificate is executed by the Design Professional this _____day of _____, 20__.

_____

(Design Professional)

By: _____

Title: _____

DESIGN PROFESSIONAL'S

CERTIFICATE OF MATERIAL COMPLETION

Project No. and Name: _____

_____

_____

Construction Professional: _____

Design Professional: _____

CERTIFICATE OF DESIGN PROFESSIONAL:

The Design Professional issues this Certificate of Material Completion of the Project and certifies as follows. Any exceptions to the below statements shall be identified and explained in Paragraph 13 below:

1. Having conducted observations and evaluations of the work in the presence of representatives of the Design Professional and its major consultants, the referenced project has been determined to be fully constructed and completed in accordance with the contract documents and all applicable laws, ordinances, codes, rules and regulations on _____ (date of Inspection for Material Completion) with the exception of items shown on the attached Final Punch List [Notice of Non-Compliant Work No. _____].

2. The "work" includes all construction, documents, submissions, attic stock, certificates, reports (including initial HVAC test and balance report), warranties, Marked-up Construction Documents, Final Certification of Costs, etc., called for in the contract documents, including all addenda and change orders.

3. The Final Punch List specifies items that constitute either a Minor Item or Permitted Incomplete Work, as defined in the General Requirements, and also stipulates an estimated completion date for each.

4. There are no outstanding Notices of Non-Compliant Work which are not restated on the Final Punch List. Such items must qualify as a Minor Item or Permitted Incomplete Work.

5. The total contract sum as of the date of Material Completion through Change Order No._____ is $0.00. The unpaid balance of the total contract sum (except as may be amended by future change orders) will be due and payable when all work has been fully completed and the contract fully performed at Project Final Completion.

6. There are no pending change orders resulting in credits or other credits due the Owner.

7. The amount to be withheld from Payment for Material Completion for each Minor Item or Permitted Incomplete Work as listed on the Final Punch List is as follows. Dates for completion of each item of Permitted Incomplete Work are indicated on the Final Punch List.

Total Value of Minor Items: $0.00	x 200%=	$0.00	
Total Value of Permitted Inc. Work:	$0.00	x 200%=	$0.00
Seasonal HVAC Balancing (Min. $1,000)	$0.00	x ____=	$0.00
Major Equipment Certificates: (Number) 0		x $500 =	$0.00
	Total Withheld =		$0.00

8. All tests and inspections required by the contract documents have been made and were reviewed by a registered architect or registered engineer of the Design Professional. All work was found to meet or was brought into compliance to meet said tests and inspections in accordance with the contract documents.

9. No work has been certified for payment that was covered prior to consent of the Design Professional.

10. All mechanical systems, equipment, apparatus and controls (electrical, heating plumbing, water, septic tank and sewage disposal fields, refrigeration, kitchen equipment, fire alarm, program and public address, etc.) have been started up, tested and inspected in the presence of a registered architect or registered engineer of the Design Professional, and have been found to be in safe operating condition, compliance with the contract documents and applicable codes.

11. All required operating instructions and maintenance manuals have been reviewed and approved for compliance with the contract documents by the Design Professional and transmitted to the Owner.

12. The State Fire Marshal has issued a Certificate (or Temporary Certificate) of Occupancy.

13. Exceptions (State Paragraph reference and explanation): _____

This Certificate is executed by the Design Professional this _____ day of _____, 20__.

_____
(Name of Design Professional Firm)

By: _____ _____ ___
(License Number and State)

Printed Name:_____
Title: _____

USING AGENCY'S

CERTIFICATE FOR MATERIAL COMPLETION

Project No. and Name: _____

_____

Using Agency: _____

This Certificate for Material Completion is given by the undersigned as follows. Any exceptions to the below statements shall be identified and explained in Paragraph 9 below:

1. I _____(name) as an authorized agent of the Using Agency having made an inspection of the work this _____(date of Inspection for Material Completion) and having reviewed the items of the Final Punch List, accept occupancy of the project from the Construction Division, Georgia State Financing and Investment Commission (GSFIC).

2. The Using Agency acknowledges the Construction Professional will be required to return to the project to complete items of the Final Punch List. The Construction Professional is required to give notice to the Using Agency (and Owner) to schedule this work and is further required to comply with the Using Agency's reasonable requests for security, protection and coordination with other separate contractors and staff functions.

3. Keys for the project have been received and accepted.

4. The Using Agency has received proper training from the Construction Professional (in the presence of the Design Professionals) of all mechanical and electrical equipment. All operating instructions and maintenance manuals required by the contract documents have been received from GSFIC.

5. All mechanical systems, equipment, apparatus and controls (electrical, heating plumbing, water, septic tank and sewage disposal fields, refrigeration, kitchen equipment, fire alarm, program and public address, etc.) have been started up, operated, tested and inspected in the presence of the Using Agency's personnel and have been found to be in safe operating condition.

6. The Using Agency acknowledges its responsibility for proper care and maintenance of the project and the prompt reporting to the Construction Division of any problems. GSFIC will administer all warranty issues with the Construction Professional, subcontractors, manufacturers and Design Professionals on behalf of the Using Agency.

7. The Using Agency has received a copy of the Construction Professional's Final Certification of Costs for Capital Asset Accounting and acknowledges its responsibility for all insurance as of the date of Material Completion.

8. The Using Agency acknowledges this authorization to occupy the Project is contingent upon issuance of an occupancy permit from the State Fire Marshal.

9. Exceptions (State Paragraph reference and explanation):_____

_____

_____

This Certificate for Material Completion is executed this _____ day of _____, 20_____.

_____ Construction Division, GSFIC

(Using Agency)

By: _____ By: _____

Title: _____ Title: _____

Authorized Representative

GSFIC-CS-402 (07-10-07)
[DBB-CM/GC-DB]

DESIGN PROFESSIONAL'S

CERTIFICATE OF FINAL COMPLETION

Project No. and Name: _____

_____

Design Professional: _____

CERTIFICATE OF DESIGN PROFESSIONAL:

The Design Professional issues this Certificate of Final Completion of the Project and certifies as follows. Any exceptions to the below statements shall be identified and explained in Paragraph 10 below:

1. Having conducted observations and evaluations of the work in the presence of representatives of the Design Professional and its major consultants, the referenced project has been determined to be fully constructed and completed in accordance with the contract documents and all applicable laws, ordinances, codes, rules and regulations on _____ (date of Inspection for Final Completion) including all items shown on the Final Punch List [Notice of Non-Compliant Work No. _____].

2. The "work" includes all construction, documents, submissions, attic stock, certificates, reports (including initial HVAC test and balance report), warranties, Marked-up Construction Documents, Final Certification of Costs, etc., called for in the contract documents, including all addenda and change orders.

3. There are no outstanding Notices of Non-Compliant Work.

4. The total contract sum as of the date of Final Completion through Change Order No._____ is $0.00.

5. There are no pending change orders resulting in credits or other credits due the Owner.

6. All tests and inspections required by the contract documents have been made and were reviewed by a registered architect or registered engineer of the Design Professional. All work was found to meet or was brought into compliance to meet said tests and inspections in accordance with the contract documents.

7. No work has been certified for payment that was covered prior to consent of the Design Professional.

8. All mechanical systems, equipment, apparatus and controls have been started up, tested and inspected in the presence of a registered architect or registered engineer of the Design Professional, and have been found to be in safe operating condition, compliance with the contract documents and applicable codes. All required operating instructions and maintenance manuals have been reviewed and approved for compliance with the contract documents by the Design Professional and transmitted to the Owner.

9. The State Fire Marshal has issued a Certificate (or Temporary Certificate) of Occupancy.

10. Exceptions (State Paragraph reference and explanation): _____

This Certificate is executed by the Design Professional this _____ day of _____, 20__.

_____
(Name of Design Professional Firm)

By: _____ _____ ___
(License Number and State)

Printed Name:_____
Title: _____

EXHIBITS

Exhibit A	Contractor Georgia Security and Immigration Compliance Act Affidavit
Exhibit B.	Georgia-Based Materials and Products Checklist

EXHIBIT A

GEORGIA SECURITY AND IMMIGRATION COMPLIANCE ACT AFFIDAVIT

Project No. and Name: _____

_____

Construction Professional: _____

STATE OF GEORGIA **COUNTY OF: _____**

CONTRACTOR AFFIDAVIT

By executing this affidavit, the undersigned Contractor verifies its compliance with O.C.G.A. §13-10-91, stating affirmatively that the individual, firm, or corporation which is contracting with the Georgia State Finance and Investment Commission has registered with and is participating in a federal work authorization program*, in accordance with the applicability provisions and deadlines established in O.C.G.A. 13-10-91.

The undersigned further agrees that, should it employ or contract with any subcontractor(s) in connection with the physical performance of services pursuant to this contract with the Georgia State Finance and Investment Commission, Contractor will secure from such subcontractor(s) similar verification of compliance with O.C.G.A. § 13-10-91 on the Subcontractor Affidavit provided in Rule 300-10-01-.08 or a substantially similar form. Contractor further agrees to maintain records of such compliance and provide a copy of each such verification to the Georgia State Finance and Investment Commission at the time the subcontractor(s) is retained to perform such service.

_____
EEV / E-Verify™ User Identification Number

_____ _____
BY: Authorized Officer or Agent Date

_____
Title of Authorized Officer or Agent of Contractor

_____
Printed Name of Authorized Officer or Agent

SUBSCRIBED AND SWORN
BEFORE ME ON THIS THE

_____ **DAY OF** _____, **20**__

_____ [NOTARY SEAL]
Notary Public

My Commission Expires: _____

*any of the electronic verification of work authorization programs operated by the United States Department of Homeland Security or any equivalent federal work authorization program operated by the United States Department of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA), P.L. 99-603

Georgia-based Materials & Products Checklist

Project Name:_____

Project Number:_____

Note: The Georgia-based Materials & Products Checklist serves to certify compliance with the requirement of Section 1.3 – Georgia-based Materials & Products, Requirements. This Checklist should be completed at the end of the construction phase of the project. The form must be submitted to the agency owner at completion.
Utilize the following spreadsheet to document the percentage of Georgia-based materials and products (building materials used in a project that are harvested, extracted, or manufactured in the State of Georgia). The general contractor shall track the materials and costs of each Georgia-based product used on the project and provide documentation to ensure compliance and obtain product data sheets. To comply, one of the three options below must be checked, "Yes" (Harvested, Extracted and/or Manufactured in Georgia). Determine if the project will use the Default Materials Value or Actual Materials Value to assess compliance with the 10% minimum guideline requirements.

Default Materials Value: Based on the total construction costs (hard costs for CSI Master Format 2004 Divisions 2-10 only)
Default Materials Value:_____ = total construction cost * 0.45

Actual Materials Value: Based on actual materials cost (excluding labor and equipment) (hard costs for CSI Master Format 2004Divisions 2-10 only)
Actual Materials Value: _____

Product	Total Product Cost	Harvested in Georgia Yes or No	Extracted in Georgia Yes or No	Manufactured in Georgia Yes or No

Product	Total Product Cost	Harvested in Georgia Yes or No	Extracted in Georgia Yes or No	Manufactured in Georgia Yes or No

Total Product Cost (Sum): _____

Georgia-based Materials & Products Calculations

Total value ($) of Georgia-based Materials & Products harvested, extracted, or manufactured: _____

Georgia-based Materials & Products as a percentage of total materials cost: _____

I have complied with the Energy Efficiency and Sustainable Construction Standards for State Buildings requirements for Georgia-based Materials & Products.

Signed (Responsible Team Member): _____ **Date:** _____

Printed Name: _____ **Organization:** _____

Supplementary General Requirements

1. AAA Minority Vendor Designee. The minority vendor designee of the Georgia State Financing and Investment Commission to act as liaison with minority vendors is the GSFIC Contracting Officer for this Project. For more information, please contact GSFIC's Procurement Director by e-mail at rey.palma@gsfic.ga.gov or for general information including information regarding the Minority Vendor Program contact the Governor's Entrepreneur & Small Business Office by e-mail at smallbusiness@georgia.org.

2. Liquidated Damages: The daily amount for Liquidated Damages as described in Paragraph 6 of the Contract and Section 1.1.6 of the General Requirements is: **$800.00** per day.

3. Inclement Weather: In reference to Section 3.3.8.4, the Contractor shall anticipate the following days of inclement weather which shall not be the basis for extensions of time or adjustment to the Contract Sum:

   Monthly Anticipated Actual Adverse Weather (Calendar Days)
   See Attached

4. Unit Prices – Sediment Barrier Silt Fence: In the event of *force majeure*, including abnormal weather conditions, and Owner requested changes, the unit prices for new sediment barrier silt fence shall be **$2.50** per linear foot and for re-installation of existing sediment barrier silt fence shall be **$2.50** per lineal foot. Unit prices include all overhead and profit.

5. Unsuitable Fill: A portion of the specified soil excavations are to be used on the Project as fill and additional excavations may be required to remove and replace unsuitable materials. Bidders are to include in the Bid the cost of excavating **500** cubic yards of unsuitable fill material. Payment will be made for all unsuitable fill material in excess of **500** cubic yards at the net unit price of **$6.00** per cubic yard, which includes all overhead and profit. In the event that it is necessary to excavate less than **500** cubic yards of unsuitable fill material, the Owner will take a credit of **$6.00** per cubic yard. The unit price of **$6.00** per cubic yard shall include the excavation, haul off, and disposal of all unsuitable fill material. The Design Professional shall be responsible for calculating the amount of all unsuitable fill material removed. Measurement of unsuitable fill material shall be calculated on the basis of in-place compacted fill material and not expanded hauled fill material.

   Bidders are to include in the Bid the cost of importing **500** cubic yards of additional fill material to the site. Payment will be made for all fill material in excess of **500** cubic yards at the net unit price of **$8.00** per cubic yard, which includes all overhead and profit. In the event it is necessary to haul in less than **500** cubic yards of fill material, the Owner will take a credit of **$8.00** per cubic yard. The unit price of **$8.00** per cubic yard shall include the haul in, placement, and compaction of fill material in accordance with the project specifications for fill material. The Design Professional shall be responsible for calculating the amount of all fill material brought to the site. Measurement of cubic yards of fill material or excavation shall be calculated using compacted in-place fill material and not expanded hauled fill material.

   When unsuitable materials are encountered, the Contractor shall request a Force Account Change Order to document the actual quantities regardless of whether the amounts are included in the bid or at variance as described above.

6. Rock: Bidders are to include in the Bid the cost of excavating **0** cubic yards of <Rippable-Mass-Trench-Caisson> rock. Payment will be made for all <Rippable-Mass-Trench-Caisson> rock in excess of **0** cubic yards at the net unit price of **$125.00** per cubic yard, which includes all overhead and profit. In the event it is necessary to excavate less than **0** cubic yards of <Rippable-Mass-Trench-Caisson> rock, the Owner will take a credit of **$125.00** per cubic yard. The unit price of **$125.00** per cubic yard shall include the excavation, haul off, and disposal of all <Rippable-Mass-Trench-Caisson> rock, as indicated in the Contract Documents, and replacement with earth as required by Section

312000 of the specifications and compacted as required by Section 312000 of the specifications. The Design Professional shall be responsible for calculating the amount of all <Rippable-Mass-Trench-Caisson> rock removed. Measurement of <Rippable-Mass-Trench-Caisson> rock shall be calculated on the basis of in-place compacted material and not expanded hauled material. The Contractor agrees to be bound by the Design Professional's determination of the quantity of all rock removed.

When rock is encountered, the Contractor shall request a Force Account Change Order to document the actual quantities regardless of whether the amounts are included in the bid or at variance as described above.

7.

END OF SUPPLEMENTARY GENERAL REQUIREMENTS

Project
Location **Athens GA**

Average Number of Days with Precipitation greater than 0.5"

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2008	1	3	4	3	1	1	3	2	2	3	2	3	28
2007	2	3	1	2	2	2	3	1	0	2	3	4	25
2006	3	3	2	1	1	1	3	5	2	2	2	2	27
2005	2	3	4	5	2	7	6	3	0	2	1	3	38
2004	1	3	1	0	1	2	1	1	3	0	5	3	21
2003	1	4	5	1	5	5	7	3	1	1	3	1	37
2002	4	1	3	0	2	4	1	0	5	3	4	6	33
2001	3	2	5	2	4	6	4	0	2	0	1	2	31
2000	3	1	4	1	1	1	2	2	3	0	3	2	23
1999	4	2	2	3	0	4	2	3	4	3	1	2	30
Avg Rain days	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**29**

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 00 3100

AVAILABLE PROJECT INFORMATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section references other information relevant to the construction of this Project that is available project information.

B. At the request of the Owner, the information identified below represents services that have been provided by others, not as an Architect's Consultant, regarding conditions that affect this Project that are beyond the responsibilities of the Architect and Architect's Consultants. Reference to such information herein is solely for the convenience of the Owner. Architect makes no representation, express or implied, as to the accuracy or validity of the information.

C. Bidders are expected to examine the site and the information available from the Owner to determine for themselves the conditions to be encountered.

D. If conditions other than those indicated in the information available from the Owner are encountered before or during construction, notify the Owner before work continues.

1.2 PROPERTY SURVEY

A. The Owner's Surveyor has performed a property survey and the some of the survey information is included on the Drawings for the convenience of the Contractor.

1.3 GEOTECHNICAL REPORT

A. Soil and subsurface investigations were conducted at the site, the results of which are found in a report dated May 22, 2009 prepared by NOVA Engineering and Environmental.

B. Reference: A copy of the report will be available to bidders at the office of the Design Professional, HKS Inc., 3445 Peachtree Road, NE, Suite 675, Atlanta, Georgia 30326, between 8:00 a.m. and 5:00 p.m., Monday through Friday.

C. Copies: Bidders will be furnished copies of the report at the cost of reproduction, postage, and handling, upon written request to the Design Professional. Such requests, accompanied by check for $20.00 shall be in the following form:

"Please forward a copy of the Subsurface Investigation Report for Building Expansion Lanier Technical College – TCSG 236. In consideration for furnishing the report, the contracting firm herein named releases the Technical College System of Georgia, the Georgia State Financing and Investment Commission, and HKS Inc. from any responsibility or obligation for the accuracy or completeness of work performed under the contract resulting from assumptions based on use of such report."

D. Status: The Subsurface Investigation Report is not a part of the contract documents.

E. Interpretation: Data concerning subsurface materials or conditions which are based upon sounding, test pits, test borings, or other means, have been obtained by the Design Professional for its use in designing the project. The accuracy or completeness of the data is not guaranteed; and therefore, the Construction Professional shall not rely on this information without independent verification. Neither the Technical College System of Georgia, the Georgia State Financing and Investment Commission, nor Design Professional will be responsible in any way for additional compensation except as provided in the General Requirements Section – Changes due to Subsurface or Other Unforeseen Conditions."

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 01 1100

SUMMARY OF WORK

PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: The project title is TCSG-236 Lanier Technical College, Building Expansion. The project consists of a renovation and expansion of the Lanier Tech Dawsonville Campus Technical College building. The expanded building will be two stories consisting of +/- 31,900 sf on level one and +/-7,156sf of area on level two. This building is adjacent to an existing adult education building and shares parking with the adjacent Dawson County Middle School.

1. Owner: Georgia State Financing and Investment Commission, The Construction Division, 270 Washington Street, 2nd Floor, Atlanta, Georgia 30334

B. Architect: The Contract Documents were prepared for this Project by HKS Inc., 3445 Peachtree Road, Suite 675, Atlanta, Georgia 30326 and their consultants identified on the Project Directory page of this Project Manual.

1.2 OWNER-FURNISHED PRODUCTS

A. Products furnished by Owner for installation by Contractor will include the following:

1. Automotive Lab Equipment.
2. Fixed Medical Equipment.
3. Welding Lab Equipment.

B. Owners Responsibilities

1. Arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
2. Arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
3. Inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
4. If Owner-furnished items are damaged, defective, or missing, arrange for replacement.
5. Arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
6. Furnish Contractor the earliest possible delivery date for Owner-furnished products.

C. Contractor's Responsibilities:

1. Using Owner-furnished earliest possible delivery dates, designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
2. Review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
3. Receiving, unloading, and handling Owner-furnished items at Project site.
4. Installation of Owner-furnished items.
5. Protecting Owner-furnished items from damage during storage, handling and installation, including damage from exposure to the elements.

6. Items damaged as a result of Contractor's operations, shall be repaired or replaced by Contractor.

1.3 MISCELLANEOUS PROVISIONS

A. Contractor shall provide a separate add alternate price for sitework on adjacent property as indicated in civil drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 01 2500

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDE

A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of Contract.

1.2 DEFINITIONS

A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by Contractor after award of Contract are considered requests for "substitutions." Following are not considered substitutions:

1. Revisions to Contract Documents requested by Owner or Architect.
2. Specified options of products and construction methods included in Contract Documents.
3. Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.3 SUBMITTALS

A. Submit three copies of each request for product substitution complete with properly executed form and all supporting data.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Bids shall be based upon providing specified materials, products, Acceptable Manufacturers, organizations, and applications; identified in these Specifications or indicated on Drawings.

B. Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples for construction activities not complying with Contract Documents does not constitute acceptable or valid request for substitution, nor does it constitute approval.

C. Contractor's substitution request will be received and considered by Architect when one or more of following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to Contract Documents are not required.
2. Proposed changes are in keeping with general intent of Contract Documents.
3. Request is timely, fully documented and properly submitted.

4. Specified product or method of construction cannot be provided within Contract Time. Request will not be considered if product or method cannot be provided as result of failure to pursue Work promptly or coordinate activities properly.
5. Specified product or method of construction cannot receive necessary approval by governing authority, and requested substitution can be approved.
6. Substantial advantage is offered Owner, in terms of cost, time, energy conservation or other considerations, after deducting additional responsibilities Owner must assume. Additional responsibilities for Owner may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
7. Specified product or method of construction cannot be provided in manner that is compatible with other materials, and where Contractor certifies that substitution will overcome incompatibility.
8. Specified product or method of construction cannot be coordinated with other materials, and where Contractor certifies that proposed substitution can be coordinated.
9. Specified product or method of construction cannot provide warranty required by Contract Documents and where Contractor certifies that proposed substitution provide required warranty.

D. Due to limited time available during bidding period, request for substitutions will not be evaluated by Architect until after Proceed Order. For period of sixty (60) consecutive calendar days after Proceed Order, substitutions will be considered by Architect. Requests for substitution after that time will be considered or rejected at the discretion of the Architect.

E. Burden of proof of equality rests with Contractor.

F. Submit separate request for each Product Substitution, on Architect's standard form "HKS Substitution Request Form 01630", copy at end of this section, supported with complete data, technical literature, drawings and samples as appropriate, including:

1. Comparison of qualities of proposed substitution with that specified. (Submit data for both products)
2. Changes required in other elements of work because of substitution.
3. Effect on construction schedule.
4. Cost data comparing proposed substitution with Product specified.
5. Required license fees or royalties.
6. Availability of maintenance service, and source of replacement materials.
7. List of appropriate installations.

G. By making request for substitution, Contractor:

1. Represents and warrants that Contractor has personally investigated proposed substitution product and determined that it is equal to or superior in all respects to that specified;
2. Represents and warrants that Contractor will provide same warranties or bonds for substitution that Contractor would for that specified.
3. Certifies that cost data presented is complete and includes all related costs under this Contract except for Architect's redesign cost, and waives all claims for additional costs related to substitution which may subsequently become apparent; and
4. Will coordinate installation of accepted substitute, making such other changes as may be required to make Work complete in all respects.

H. Architect will review requests for substitutions with reasonable promptness, and notify Contractor, in writing, of decision to accept or reject requested substitution.

I. Owner and Architect reserve right to accept or reject proposed substitutions. Each request shall state amount of savings to Owner, if substitution is accepted. Acceptance of proposed substitution does not constitute approval or inclusion in Architect's and Consultant's Documents. Pay applications certification, change orders, and certificate of substantial completion will contain such qualification.

J. Cost of testing required for analysis of proposed substitution shall be paid for by Contractor at testing agency selected and approved by Architect.

K. Should substitution be accepted, Contractor shall be responsible to make necessary adjustments in Work which may be affected as result of substitution at no additional cost.

L. Contractor warrants that substituted material or system will perform same as original specified material or system would have performed. Should accepted substitution fail to perform as required, Contractor shall replace substitute material or system with that specified and bear costs incurred thereby.

PART 3 - EXECUTION (Not Used)

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 01 2600

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Refer to Division 01 Section "Substitution Procedures" for administrative procedures for handling requests for substitutions made after Contract award.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on Architect's standard form HKS 710 "Architect's Supplemental Instructions".

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time using Architect's standard form HKS 709 "Proposed Change". If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request and after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include an updated Construction Progress Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor shall notify the Architect in accordance with Section 3, Part 2 of the General Requirements.

1.4 CHANGE ORDER PROCEDURES

A. Owner will issue Change Orders in accordance with Section 3, Part 2 of the General Requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 2900

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Construction Progress Schedule.

1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:

    a. Application for Payment forms with Continuation Sheets.
    b. Submittals Schedule.

2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Application for Payment.
3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the Schedule of Values:

    a. Project name and location.
    b. Name of Architect.
    c. Architect's project number.
    d. Contractor's name and address.
    e. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

    a. Related Specification Section or Division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value. Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

8. Schedule Updating: Update and resubmit the Schedule of Values before the next Application for Payment when Change Orders result in a change in the Contract Sum.

1.3 ARCHITECTS COST DATA

A. In addition to the Schedule of Values, submit an itemized Cost Data Report on HKS Form 757A and 757B. Initial submission shall be included with contractors first Application for Payment. Final updated submission shall be included with contractors final Application for Payment.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

    1. Initial Application for Payment, Application for Payment at time of Material Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Forms: Use Owner's standard form. Refer to Section 7 of the General Requirements.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

    1. Entries shall match data on the Schedule of Values and Construction Progress Schedule. Use updated schedules if revisions were made.
    2. Include amounts of Change Orders issued before last day of construction period covered by application.

E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Contract Compliance Specialist by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Delays: Submit each Application for Payment with Contractor's waiver of mechanic's lien for construction period covered by the application.

    a. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Construction Progress Schedule.
4. Products list.
5. Schedule of unit prices.
6. Submittals Schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performances and payment bonds.

H. Application for Payment at Material Completion: Refer to Section 6, Part 4 of the General Requirements.

I. Final Payment Application: Refer to Section 6, Part 6 of the General Requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 3100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project.

1.2 COORDINATION

A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Construction Progress Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1.3 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Indicate relationship of components shown on separate Shop Drawings.

2. Indicate required installation sequences.

B. Staff Names: Within 15 days of starting construction operations, submit a list of principal staff assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone.

1.4 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.

B. Preconstruction Conference: The Architect will schedule a preconstruction conference before starting construction, at a time and location convenient to Owner, Contractor and Architect, but no later than 15 days after date of Proceed Order.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.
b. Phasing.
c. Critical work sequencing.
d. Designation of responsible personnel.
e. Procedures for processing field decisions and Change Orders.
f. Procedures for processing Applications for Payment.
g. Distribution of the Contract Documents.
h. Submittal procedures.
i. Preparation of Record Documents.
j. Use of the premises.
k. Responsibility for temporary facilities and controls.
l. Parking availability.
m. Office, work, and storage areas.
n. Equipment deliveries and priorities.
o. First aid.
p. Security.
q. Progress cleaning.
r. Working hours.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. Contract Documents.
    b. Options.
    c. Related Change Orders.
    d. Purchases.
    e. Deliveries.
    f. Submittals.
    g. Review of mockups.
    h. Possible conflicts.
    i. Compatibility problems.
    j. Time schedules.
    k. Weather limitations.
    l. Manufacturer's written recommendations.
    m. Warranty requirements.
    n. Compatibility of materials.
    o. Acceptability of substrates.
    p. Temporary facilities and controls.
    q. Space and access limitations.
    r. Regulations of authorities having jurisdiction.
    s. Testing and inspecting requirements.
    t. Required performance results.
    u. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements.
4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at regular intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
3. Construction Progress Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Construction Progress Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

4. Review present and future needs of each entity present, including the following:

   a. Interface requirements.
   b. Sequence of operations.
   c. Status of submittals.
   d. Deliveries.
   e. Off-site fabrication.
   f. Access.
   g. Site utilization.
   h. Temporary facilities and controls.
   i. Work hours.
   j. Hazards and risks.
   k. Progress cleaning.
   l. Quality and work standards.
   m. Change Orders.
   n. Documentation of information for payment requests.

5. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
6. Schedule Updating: Revise Construction Progress Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

E. Coordination Meetings: Conduct Project coordination meetings on an as-needed basis. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: Each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work
2. Agenda: Review items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

1.5 ELECTRONIC PROJECT MANAGEMENT SOFTWARE

A. This project will be set up to use the project management system "Attolist" web-based construction administration software. The Contractor's key personnel and the project construction team members will be required to utilize this system.

B. Attolist is a collaborative web environment which expedites and organizes the review process and saves substantial resources by minimizing administration, printing, shipping and courier costs. Contractor shall allocate the appropriate amount of money per month for use of Attolist within the contract sum. The fee shall be calculated from the start of construction through the Date of Final Completion. There is no separate user license as the monthly project fee covers unlimited users per project.

C. A web-based tutorial will be provided to the Contractor and project construction team members who are awarded the contract. This training will take place no later than one week from the "Proceed Order" date.

D. PDF mark-up software is included with the Attolist software for all users. No other PDF markup software is required.

E. Attolist shall provide the project an independent electronic archive of all data at the end of the project via FTP or DVD(s). Utilize this system for preparation and transmission of electronic files of Project Record Documents as required in Division 01 Section "Closeout Procedures".

F. Refer to use of electronic project management software for project communications and submittal procedures as required in other Division 01 Sections.

G. Visit www.attolist.com or call (877) 442-3713 for additional information on Attolist.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 01 3120

PROJECT COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative procedures for preparation and submission of project communications documents.

1.2 DEFINITIONS

A. Project communications documents shall be defined as the following:

1. Letters.
2. Memoranda.
3. Fax Communications.
4. E-Mail Communications / Internet Communications / Project Management Software Communications.
5. RFI (Request for Information – Contractor).
6. RFI-A (Request for Information – Architect).

1.3 FORMAT

A. Letters, Memoranda, and Fax Communications: Submit in formats acceptable to the Architect.

B. E–Mail Communications / Internet Communications / Project Management Software Communications: Submit in forms and formats acceptable to and as approved by the Architect.

C. RFI (Request for Information – Contractor): Submit on forms furnished by the Architect, or on other forms as approved by the Architect. Unless otherwise approved use, Architect's standard form HKS 750, "Request For Information".

D. RFI-A (Request for Information - Architect), will be submitted by Architect to Contractor on Architect's standard form.

PART 2 - PRODUCTS

A. Electronic Project Management Software: As required by Division 01 Section "Project Management and Coordination".

PART 3 - EXECUTION

3.1 PROJECT COMMUNICATIONS DOCUMENTS

A. Letters, Memoranda, and Fax communications documents shall be submitted in a timely manner so as to facilitate project delivery and coordination. Routing of communications shall be as established in the Contract, the Contract Documents and the Pre-Construction Conference. Communications documents shall be transmitted or forwarded in a manner consistent with the schedule and progress of the work.

B. E–Mail Communications, Internet Communications, and Project Management Software programs must be compatible with the Architect's and Owner's computer systems and equipment. The responsibility for all costs for management of these systems, including, but not limited to, licensing, on site training or other training necessary for the proper operation of such systems, shall be by the Contractor. The Contractor shall keep written records and hard file copies of all electronic communications. Failure of the Contractor to keep such records shall waive the Contractor's right to rely on such communications and such communications shall be deemed to have not taken place.

1. Electronic File of Project Communication Documents: Provide Architect with an independent electronic archive of project communication documents using electronic project management software as defined in Division 01 Section "Project Management and Coordination",

C. RFI (Request for Information – Contractor) shall be defined and limited to a request from the Contractor seeking interpretation or clarification of the requirements of the Contract Documents. Such requests shall comply with the following requirements:

1. RFI requests shall be submitted in a timely manner, well in advance of related work, and allow sufficient time for the resolution of issues relating to the request for interpretation or clarification. Contractor shall schedule the submission of RFI's so as to moderate and manage the flow of RFI requests. RFI's shall be submitted in a manner consistent with the schedule and progress of the work, and shall not be submitted in a sporadic and/or excessive manner.
2. RFI requests shall be numbered in a sequential manner and contain a detailed description of the areas of work requiring interpretation or clarification. Include drawing and specification references, sketches, technical data, brochures, or other supporting data as deemed necessary by the Architect, for the Architect to provide the interpretations and clarifications requested. The Contractor shall include a "Proposed Solution" to the issue requiring interpretation or clarification.
3. RFI's submitted to the Contractor by Sub-Contractors, vendors, suppliers, or other parties to the work shall be reviewed by the Contractor prior to submission to the Architect. If the Architect deems that such RFI requests have not been adequately reviewed by the Contractor, such requests will be returned to the Contractor for further action. Sub-Contractor's RFI shall contain a "Proposed Solution".
4. RFI requests shall not contain submittals, substitutions requests, routine communications, correspondence, memos, claims, or any information required by other areas of the Contract Documents. RFI requests containing such information will be returned to the Contractor without action by the Architect.

5. RFI requests are limited to a request for interpretation or clarification of the requirements of the Contract Documents. Interpretations provided by the Architect shall not change the requirements of the Contract or the Contract Documents. If the Contractor determines that the Architect's response to an RFI gives cause for a change in the Contract or the Contract Documents, the Contractor shall promptly, within 5 working days, give written notice to the Architect of request for adjustments. Requests for adjustments to the Contract shall be submitted in a manner consistent with the terms and conditions of the Contract Documents.
6. If the Architect, after review, determines that any RFI has been submitted in an incomplete manner, is unnecessary, or does not otherwise comply with the requirements of this Section, the RFI will be returned without action to the Contractor. The Contractor shall delete the original submittal date from the RFI log and enter a new submittal date at the time of re-submittal.

D. RFI-A (Request for Information – Architect) shall be defined as a request by the Architect for information relating to the obligations of the Contractor under the Contract.

1. After receipt of an RFI-A the Contractor shall provide a written response to the Architect within 5 working days. Responses shall be thorough, complete and shall contain all information requested by the Architect.
2. An RFI-A shall be limited to a request by the Architect for information related to the project. The RFI-A shall not be construed as authorizing or directing a change in the Contract or the Contract Documents.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 01 3200

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities that must start and finish on the planned early start and finish times.
2. Predecessor activity is an activity that must be completed before a given activity can be started.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

H. Major Area: A story of construction, a separate building, or a similar significant construction element.

I. Milestone: A key or critical point in time for reference or measurement.

1.3 SUBMITTALS

A. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for Architect's final release or approval.

B. Preliminary Construction Schedule: Submit two printed copies; one a single sheet of reproducible media, and one a print.

C. Preliminary Network Diagram: Submit two printed copies; one a single sheet of reproducible media, and one a print; large enough to show entire network for entire construction period.

D. Construction Progress Schedule: Submit two printed copies of initial schedule, one a reproducible print and one a blue- or black-line print, large enough to show entire schedule for entire construction period.

E. CPM Reports: Concurrent with CPM schedule, submit three printed copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from the Proceed Order until most recent Application for Payment.

F. Construction Photographs: Submit 2 sets of prints and 2 sets of CD ROMs each containing digital files of photographic views of required Preconstruction Photographs, Periodic Construction Photographs (to be submitted with monthly Application for Payment), and Final Completion Construction Photographs.

G. Daily Construction Reports: Submit two copies at weekly intervals.

H. Material Location Reports: Submit two copies at monthly intervals.

I. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

J. Special Reports: Submit two copies at time of unusual event.

1.4 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Construction Progress Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and the Construction Progress Schedule.
2. Update Submittal: Submit concurrently with the update submittal of Contractor's Construction Schedule.

2.2 CONSTRUCTION PROGRESS SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for the Proceed Order to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
4. Startup and Testing Time: Include not less than 7 days for startup and testing.
5. Material Completion: Indicate completion in advance of date established for Material Completion, and allow time for Architect's administrative procedures necessary for certification of Material Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.

3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Products Ordered in Advance: Include a separate activity for each product.
5. Owner-Furnished Products: Include a separate activity for each product.
6. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Material Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Startup and placement into final use and operation.

8. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

    a. Structural completion.
    b. Permanent space enclosure.
    c. Completion of mechanical installation.
    d. Completion of electrical installation.
    e. Material Completion.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Proceed Order, Material Completion, and Final Completion.

F. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.

    1. Refer to Division 01 Section "Payment Procedures" for cost reporting and payment procedures.

G. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

H. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams by experienced specialist in CPM scheduling and reporting using AON (activity-on-node) format.

B. Preliminary Network Diagram: Submit diagram within 14 days of date established for the Proceed Order. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Construction Progress Schedule using a CPM network analysis diagram.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Proceed Order.
2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

    a. Preparation and processing of submittals.
    b. Purchase of materials.
    c. Delivery.
    d. Fabrication.
    e. Installation.

2. Processing: Process data to produce output data or a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
3. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Principal events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.

7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the Schedule of Values).

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

G. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.

    a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
    b. Submit value summary printouts one week before each regularly scheduled progress meeting.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. High and low temperatures and general weather conditions.
5. Accidents.
6. Meetings and significant decisions.
7. Unusual events (refer to special reports).
8. Stoppages, delays, shortages, and losses.
9. Meter readings and similar recordings.
10. Emergency procedures.
11. Orders and requests of authorities having jurisdiction.
12. Change Orders received and implemented.
13. Construction Change Directives received.
14. Services connected and disconnected.
15. Equipment or system tests and startups.
16. Partial Completions and occupancies.
17. Material Completions authorized.

B. Material Location Reports: At monthly intervals, prepare a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONSTRUCTION PROGRESS SCHEDULE

A. CPM Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.

1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

B. Construction Progress Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Actual Completion percentage for each activity.

C. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

3.2 CONSTRUCTION PHOTOGRAPHS

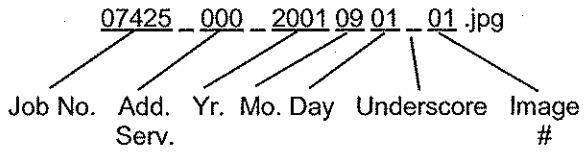
A. Photographer: Engage a qualified professional commercial photographer to take electronic construction photographs.

B. Minimum Digital Camera Resolution: 1800 x 1200 dpi (dots per inch) @ 72 dpi resolution.

C. Acceptable Electronic File Format: .jpg, .tif., .tiff., .tga., jpe., or .png.

D. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.

E. Image File Naming Convention:



F. Print Format: 8 by 10 inch smooth surface matte prints on single-weight commercial-grade stock, mounted on linen or card stock to allow a 1 inch wide margin and enclosed back to back in clear plastic sleeves that are punched for standard 3-ring binder.

G. Print Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:

1. Name of Project.
2. Name and address of photographer.
3. Name of Architect.
4. Name of Contractor.
5. Date photograph was taken.
6. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

H. Preconstruction Photographs: Before starting construction, take 4 photographs of Project site and surrounding properties from different vantage points, as directed by Architect. Show existing conditions adjacent to property. Submit prints and CD ROMs with digital files as required under "Submittals" Article.

I. Periodic Construction Photographs: Take 4 photographs monthly, coinciding with cutoff date associated with each Application for Payment. Photographer shall select vantage points to best show status of construction and progress since last photographs were taken. Submit prints and CD ROMs with digital files as required under "Submittals" Article.

1. Field Office Prints: In addition to prints required to be submitted under "Submittals" Article, make and retain in field office at Project site available at all times for reference, one set of prints of periodic construction photographs. Identify photographs the same as for those submitted to Architect.

J. Final Completion Construction Photographs: Take 8 photographs after date of Material Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points. Submit prints and CD ROMs with digital files as required under "Submittals" Article.

END OF SECTION

SECTION 01 3300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, Certifications and other miscellaneous submittals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's approval. Submittals may be rejected for not complying with requirements.

C. Field samples: Full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

D. Mock-ups: Full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

1.3 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
3. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
4. Utilize electronic project management software program to process submittals when feasible with the type and extent of submittals. Refer to Division 01 Section "Project Management and Coordination" for description of electronic project management software.

C. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow 21 days for initial review of each submittal.
3. If intermediate submittal is necessary, process it in same manner as initial submittal.
4. Allow 15 days for processing each resubmittal.
5. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Unique identifier, including revision number.
    i. Number and title of appropriate Specification Section.
    j. Drawing number and detail references, as appropriate.
    k. Other necessary identification.

F. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

1. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review received from sources other than Contractor.

1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.

3. Transmittal Form: Provide Contractor's standard form with locations on form for the following information:

   a. Project name.
   b. Date.
   c. Destination (To:).
   d. Source (From:).
   e. Names of subcontractor, manufacturer, and supplier.
   f. Category and type of submittal.
   g. Submittal purpose and description.
   h. Submittal and transmittal distribution record.
   i. Remarks.
   j. Signature of transmitter.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. Submit minimum of one reproducible and two prints of Shop Drawings until final acceptance. Submit one additional print of Structural, Mechanical and Electrical items. Reproducible and one print will be returned to the General Contractor after Architect's review.

C. Submit minimum of four copies of Product Data until final acceptance. Submit one additional copy of Structural, Mechanical and Electrical items. Three copies of the Product Data will be returned to the General Contractor after Architect's review.

D. Submit minimum of duplicates of Samples. Additional samples may be required for specific items for coordination of finishes.

E. Submit additional copies of Samples and Product Data as necessary for distribution to subcontractors. Contractor shall obtain and distribute required prints of Shop Drawings made from reviewed and stamped reproducible. Number of copies of Product Data, Samples and Shop Drawings to be submitted shall be established in the pre-construction conference.

F. Contractor shall review and stamp with his approval submittals. Submittals which do not bear Contractor's approval stamp shall be returned without review. Stamp shall include statement, "This submittal has been reviewed for compliance with requirements of the work and of the Contract Documents".

G. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

   1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.

3. Include the following information, as applicable:

    a. Manufacturer's written recommendations.
    b. Manufacturer's product specifications.
    c. Manufacturer's installation instructions.
    d. Standard color charts.
    e. Manufacturer's catalog cuts.
    f. Wiring diagrams showing factory-installed wiring.
    g. Printed performance curves.
    h. Operational range diagrams.
    i. Mill reports.
    j. Standard product operating and maintenance manuals.
    k. Compliance with recognized trade association standards.
    l. Compliance with recognized testing agency standards.
    m. Application of testing agency labels and seals.
    n. Notation of coordination requirements.
    o. Certification that products are appropriate for installation indicated.

H. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Include the following information, as applicable:

    a. Dimensions.
    b. Identification of products.
    c. Fabrication and installation drawings.
    d. Roughing-in and setting diagrams.
    e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    f. Shopwork manufacturing instructions.
    g. Templates and patterns.
    h. Schedules.
    i. Design calculations.
    j. Compliance with specified standards.
    k. Notation of coordination requirements.
    l. Notation of dimensions established by field measurement.

2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.

I. Coordination Drawings: Comply with requirements in Division 01 Section "Project Management and Coordination."

J. Samples: Prepare physical units of materials or products, including the following:

1. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
2. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected.
3. Samples include, but are not limited to, the following:

    a. Partial sections of manufactured or fabricated components.
    b. Small cuts or containers of materials.

c. Complete units of repetitively used materials.
d. Swatches showing color, texture, and pattern; color range sets.
e. Components used for independent testing and inspection.

4. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side that includes the following:

   a. Generic description of Sample.
   b. Product name or name of manufacturer.
   c. Sample source.

5. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.

   a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three sets of paired units that show approximate limits of the variations.
   b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

6. Number of Samples for Initial Selection: Submit three full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return two submittals with options selected.
7. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

K. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit one copy of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

3. Test and Inspection Reports: Comply with requirements in Division 01 Section "Quality Control."

B. Construction Progress Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation."

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.

H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

J. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.

K. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

L. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.

M. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

N. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

O. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 01 Section "Closeout Procedures."

P. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

Q. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

R. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

S. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

T. Construction Photographs: Comply with requirements in Division 01 Section "Construction Progress Documentation."

U. Industry Standards: Where other Sections of the Specifications require that a product, material, or installation complies with specified industry standard, submit copies of standards at same time as submittal of other specified submittals.

1. Submit copies of reference standards specified such as ASTM, UL, FM, ANSI, ETC., for each material or installation of material specified.
2. Submit copies of trade association standards specified such as NRCA, BIA, AWI, SMACNA, ETC., for each material, process fabrication, or installation specified.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Except for submittals for the record, for information and similar purposes, where action and return on submittals is required or requested, the Architect will review each submittal, mark to indicate the action taken, and return.

C. Compliance with specified characteristics is the Contractor's responsibility, and not considered part of the Architect's review and indication of action taken.

D. Action Stamp: The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp appropriately to indicate the action taken, as follows:

1. Final-But-Restricted Release: When submittals are marked "Accepted as Noted," the Work covered by the submittal may proceed provided it complies with both the Architect's notations or corrections on the submittal and requirements of the Contract Documents. Final acceptance will depend on that compliance.
2. Returned for Resubmittal: When submittal is marked "Not Accepted" or "Revise Resubmit," do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the Architect's notations. Resubmit without delay. Repeat if necessary to obtain a different action mark.

    a. Do not permit submittals marked "Not Accepted or Revise Resubmit" to be used at the Project site, or elsewhere where construction is in progress.

3. Other Action: Where a submittal is primarily for information or record purposes, or for special processing or other Contractor activity, the submittal will be returned, marked "Not Reviewed" or "Not Reviewed; submittal not required by Contract Documents".

E. Architect's acceptance of Shop Drawings, Samples or Product Data which deviates from the Contract Documents does not authorize changes to the Contract Sum. Submit in writing at the time of submission any changes to the Contract Sum affected by such Shop Drawings, Samples or Product Data, otherwise, claim for extras will not be considered.

F. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

G. Electronic File of Submittal Documents: Provide Architect with an independent electronic archive of project submittal documents using electronic project management software as defined in Division 01 Section "Project Management and Coordination".

END OF SECTION

SECTION 01 4200

REFERENCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes reference standards, definitions and specification format and content.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. Indicated: The term "indicated" refers to requirements expressed by graphic representations, or in written form on Drawings, in Specifications, and in other Contract Documents. Terms such as "shown", "noted", "scheduled", and "specified" are used to help the user locate the reference.

C. Directed: The term "directed" is a command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," and "permitted" have the same meaning as "directed."

D. Approved: The term "approved", when used to convey Architect's action on Contractor's submittals, applications, and requests, is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

E. Regulations: The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. Furnish: The term "furnish" means supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. Install: The term "install" describes operations at Project site including unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. Provide: The term "provide" means to furnish and install, complete and ready for the intended use.

I. Submitted: The terms "submitted", "reported", "satisfactory" and similar words and phrases means submitted to Architect, reported to Architect and similar phrases.

J. Installer: An "Installer" is the Contractor or another entity engaged by the Contractor, as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

K. Experienced: The term "experienced", when used with an entity, means having successfully completed a minimum of ten previous projects similar in size and scope to this Project; being familiar with the special requirements indicated, and having complied with requirements of authority having jurisdiction.

L. Trades: Using terms such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter". It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

M. Project Site: The term "Project site" means the space available for performing construction activities. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

N. Testing Agencies: A "testing agency" is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on the 49-Division format and CSI/CSC's "Master Format" numbering system.

1. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.

B. Specification Content: This Specification uses certain conventions regarding the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
3. The words "shall" "shall be" or "shall comply with", depending on the context are implied where a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents, unless otherwise indicated.

C. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

D. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.

E. Copies of Standards: Each entity engaged in construction on the Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where other Sections of the Specifications require that a product, material, or installation complies with specified industry standard, the Contractor shall obtain copies directly from the publication source, and submit copies of standards at same time as submittal of other specified submittals.

F. Industry Organization Abbreviations and Acronyms: Where abbreviations and acronyms are used in Specifications and other Contract Documents they shall mean the name of a trade association, standards-developing organization or other entity in the context of referencing a standard or publication. The following abbreviations and acronyms, as referenced in the Contract Documents, mean the associated names.

1. Names and Web site addresses are subject to change and are believed, but not assured, to be accurate and up to date as of the date of Contract Documents.
2. Refer to Gale Research's "Encyclopedia of Associations," or Columbia Book's "National Trade and Professional Association of the U.S.".

AA	Aluminum Association, Inc. (The)	www.aluminum.org
AAADM	American Association of Automatic Door Manufacturers	www.taol.com/aaadm
AABC	Associated Air Balance Council	www.aabchq.com
AAMA	American Architectural Manufacturers Association	www.aamanet.org
AAN	American Association of Nurserymen	(See ANLA)
AASHTO	American Association of State Highway and Transportation Officials	www.aashto.org
AATCC	American Association of Textile Chemists and Colorists	www.aatcc.org
ABMA	American Bearing Manufacturers Association	www.abma-dc.org
ACI	American Concrete Institute/ACI International	www.aci-int.org
ACPA	American Concrete Pipe Association	www.concrete-pipe.org
ADC	Air Diffusion Council	
AEIC	Association of Edison Illuminating Companies, Inc. (The)	www.aeic.org
AFPA	American Forest & Paper Association	(See AF&PA)
AF&PA	American Forest & Paper Association	www.afandpa.org
AGA	American Gas Association	www.aga.org
AGC	Associated General Contractors of America (The)	www.agc.org
AHA	American Hardboard Association	www.ahardbd.org
AHAM	Association of Home Appliance Manufacturers	www.aham.org
AI	Asphalt Institute	www.asphaltinstitute.org
AIA	American Institute of Architects (The)	www.aiaonline.org
AISC	American Institute of Steel Construction, Inc.	www.aisc.org
AISI	American Iron and Steel Institute	www.steel.org
AITC	American Institute of Timber Construction	
ALA	American Laminators Association	(See LMA)
ALCA	Associated Landscape Contractors of America	www.alca.org
ALSC	American Lumber Standard Committee	
AMCA	Air Movement and Control Association International, Inc.	www.amca.org
ANLA	American Nursery & Landscape Association (Formerly: AAN - American Association of Nurserymen)	www.anla.org

ANSI	American National Standards Institute	www.ansi.org
AOSA	Association of Official Seed Analysts	www.zianet.com/AOSA
APA	APA-The Engineered Wood Association	www.apawood.org
APA	Architectural Precast Association	www.archprecast.org
API	American Petroleum Institute	www.api.org
ARI	Air-Conditioning & Refrigeration Institute	www.ari.org
ASCA	Architectural Spray Coaters Association	www.ascassoc.com
ASCE	American Society of Civil Engineers	www.asce.org
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers	www.ashrae.org
ASME	ASME International (American Society of Mechanical Engineers International)	www.asme.org
ASSE	American Society of Sanitary Engineering	www.asse-plumbing.org
ASTM	American Society for Testing and Materials	www.astm.org
AWCI	AWCI International (Association of Wall and Ceiling Industries International)	www.awci.org
AWCMA	American Window Covering Manufacturers Association	(See WCMA)
AWI	Architectural Woodwork Institute	www.awinet.org
AWPA	American Wood-Preservers' Association	www.awpa.com
AWS	American Welding Society	www.aws.org
AWWA	American Water Works Association	www.awwa.org
BHMA	Builders Hardware Manufacturers Association	www.buildershardware.com
BIA	Brick Industry Association (The)	www.bia.org
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International)	www.bifma.com
CCC	Carpet Cushion Council	www.carpetcushion.org
CCFSS	Center for Cold-Formed Steel Structures	www.umr.edu/~ccfss
CDA	Copper Development Association Inc.	www.copper.org
CEA	Canadian Electricity Association (The)	www.canelect.ca
CFFA	Chemical Fabrics & Film Association, Inc.	www.taol.com/cffa
CGA	Compressed Gas Association	www.cganet.com
CGSB	Canadian General Standards Board	www.pwgsc.gc.ca/cgsb
CIMA	Cellulose Insulation Manufacturers Association	www.cellulose.org
CISCA	Ceilings & Interior Systems Construction Association	www.cisca.org
CISPI	Cast Iron Soil Pipe Institute	www.cispi.org
CLFMI	Chain Link Fence Manufacturers Institute	www.chainlinkinfo.com (under construction)
CPA	Composite Panel Association (Formerly: National Particleboard Association)	www.pbmdf.com
CPPA	Corrugated Polyethylene Pipe Association Division of Plastics Pipe Institute	www.cppa-info.org
CRI	Carpet and Rug Institute (The)	www.carpet-rug.com
CRSI	Concrete Reinforcing Steel Institute	www.crsi.org
CSA	CSA International (Formerly: IAS - International Approval Services) Division of Canadian Standards Association	www.iasapprovals.org
CSI	Construction Specifications Institute (The)	www.csinet.org
CSSB	Cedar Shake & Shingle Bureau	www.cedarbureau.org
CTI	Cooling Tower Institute	www.cti.org
DHI	Door and Hardware Institute	www.dhi.org
EIA/TIA	Electronic Industries Alliance/Telecommunications Industry Association	www.eia.org
EIMA	EIFS Industry Members Association	www.eifsfacts.com
EJMA	Expansion Joint Manufacturers Association, Inc.	www.ejma.org
FCI	Fluid Controls Institute	www.fluidcontrolsinstitute.org

FGMA	Flat Glass Marketing Association	(See GANA)
FM	Factory Mutual System	(See FMG)
FMG	FM Global (Formerly: FM - Factory Mutual System)	www.fmglobal.com
GA	Gypsum Association	www.gypsum.org
GANA	Glass Association of North America (Formerly: FGMA - Flat Glass Marketing Association)	www.glasswebsite.com/gana
GRI	Geosynthetic Research Institute	www.drexel.edu/gri
GTA	Glass Tempering Division of Glass Association of North America	(See GANA)
HI	Hydraulic Institute	
HI	Hydronics Institute Division of Gas Appliance Manufacturers Association	www.gamanet.org
HMMA	Hollow Metal Manufacturers Association Division of National Association of Architectural Metal Manufacturers	(See NAAMM)
HPVA	Hardwood Plywood & Veneer Association	www.hpva.org
HPW	H. P. White Laboratory, Inc.	
IAS	International Approval Services (See CSA International)	
ICEA	Insulated Cable Engineers Association, Inc.	www.icea.net
ICRI	International Concrete Repair Institute	www.icri.org
IEC	International Electrotechnical Commission	www.iec.ch
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)	www.ieee.org
IESNA	Illuminating Engineering Society of North America (The)	www.iesna.org
IGCC	Insulating Glass Certification Council	www.igcc.org
ILI	Indiana Limestone Institute of America, Inc.	www.iliai.com
IRI	HSB Industrial Risk Insurers	www.industrialrisk.com
ITS	Intertek Testing Services	www.itsglobal.com
IWS	Insect Screening Weavers Association (Now defunct)	
KCMA	Kitchen Cabinet Manufacturers Association	www.kcma.org
LGSI	Light Gage Structural Institute	www.loseke.com
LMA	Laminating Materials Association (Formerly: ALA - American Laminators Association)	www.lma.org
LPI	Lightning Protection Institute	www.lightning.org
LSGA	Laminated Safety Glass Association	(See GANA)
MBMA	Metal Building Manufacturers Association	www.mbma.com
MFMA	Maple Flooring Manufacturers Association	www.maplefloor.org
MFMA	Metal Framing Manufacturers Association	
MGPHO	Medical Gas Professional Healthcare Organization, Inc.	www.mgpho.org
MHIA	Material Handling Industry of America	www.mhia.org
MIA	Marble Institute of America	www.marble-institute.com
ML/SFA	Metal Lath/Steel Framing Association (See SSMA)	
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry, Inc.	www.mss-hq.com
NAAMM	National Association of Architectural Metal Manufacturers	www.naamm.org
NAAMM	North American Association of Mirror Manufacturers	(See GANA)
NACE	NACE International (National Association of Corrosion Engineers International)	www.nace.org
NAIMA	North American Insulation Manufacturers Association	www.naima.org
NAMI	National Accreditation and Management Institute, Inc.	
NAPM	National Association of Photographic Manufacturers	(See PIMA)

NBGQA	National Building Granite Quarries Association, Inc.	www.nbgqa.com
NCMA	National Concrete Masonry Association	www.ncma.org
NCPI	National Clay Pipe Institute	www.ncpi.org
NCTA	National Cable Television Association	www.ncta.com
NEBB	National Environmental Balancing Bureau	www.nebb.org
NECA	National Electrical Contractors Association	www.necanet.org
NeLMA	Northeastern Lumber Manufacturers' Association	www.nelma.org
NEMA	National Electrical Manufacturers Association	www.nema.org
NETA	InterNational Electrical Testing Association	www.electricnet.com/neta
NFPA	National Fire Protection Association	www.nfpa.org
NFRC	National Fenestration Rating Council	www.nfrc.org
NGA	National Glass Association	www.glass.org
NHLA	National Hardwood Lumber Association	www.natlhardwood.org
NLGA	National Lumber Grades Authority	www.nlga.org
NOFMA	National Oak Flooring Manufacturers Association	www.nofma.org
NPA	National Particleboard Association	(See CPA)
NRCA	National Roofing Contractors Association	www.nrca.net
NRMCA	National Ready Mixed Concrete Association	www.nrmca.org
NSA	National Stone Association	www.aggregates.org
NSF	NSF International (National Sanitation Foundation International)	www.nsf.org
NTMA	National Terrazzo & Mosaic Association (The)	www.ntma.com
NWWDA	National Wood Window and Door Association	(See WDMA)
PCI	Precast/Prestressed Concrete Institute	www.pci.org
PDCA	Painting and Decorating Contractors of America	www.pdca.com
PDI	Plumbing & Drainage Institute	www.pdionline.org
PGI	PVC Geomembrane Institute/Technology Program University of Illinois-Urbana Champaign	//pgi-tp.ce.uiuc.edu
PIMA	Photographic & Imaging Manufacturers Association (Formerly: NAPM - National Association of Photographic Manufacturers)	www.pima.net
RCSC	Research Council on Structural Connections (c/o AISC)	www.boltcouncil.org
RFCI	Resilient Floor Covering Institute	(Contact by mail only)
RIS	Redwood Inspection Service Division of the California Redwood Association	www.calredwood.org
RMA	Rubber Manufacturers Association	www.rma.org
SAE	SAE International	www.sae.org
SDI	Steel Deck Institute	www.sdi.org
SDI	Steel Door Institute	www.steeldoor.org
SEFA	Scientific Equipment and Furniture Association	www.sefalabfurn.com
SGCC	Safety Glazing Certification Council	www.sgcc.org
SIGMA	Sealed Insulating Glass Manufacturers Association	www.sigmaonline.org/sigma
SJI	Steel Joist Institute	www.steeljoist.org
SMA	Screen Manufacturers Association	
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association	www.smacna.org
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division)	www.sprayfoam.org
SPI	The Society of the Plastics Industry, Inc.	www.plasticsindustry.org
SPIB	Southern Pine Inspection Bureau (The)	www.spib.org
SPI/SPFD	The Society of the Plastics Industry, Inc. Spray Polyurethane Foam Division	(See SPI)

SPRI	SPRI (Single Ply Roofing Institute)	www.spri.org
SSINA	Specialty Steel Industry of North America	www.ssina.com
SSMA	Steel Stud Manufacturers Association (Formerly: ML/SFA - Metal Lath/Steel Framing Association)	www.ssma.com
SSPC	SSPC: The Society for Protective Coatings	www.sspc.org
STI	Steel Tank Institute	www.steeltank.com
SWI	Steel Window Institute	www.steelwindows.com
SWRI	Sealant, Waterproofing & Restoration Institute	www.swrionline.org
TCA	Tile Council of America, Inc.	www.tileusa.com
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance	www.tiaonline.org
TPI	Truss Plate Institute	
TPI	Turfgrass Producers International	www.turfgrasssod.org
UFAC	Upholstered Furniture Action Council	www.ufac.org
UL	Underwriters Laboratories Inc.	www.ul.com
UNI	Uni-Bell PVC Pipe Association	//members.aol.com/unibell
USITT	United States Institute for Theatre Technology, Inc.	www.culturenet.ca/usitt
USP	U.S. Pharmacopeia	www.usp.org
WASTEC	Waste Equipment Technology Association	www.wastec.org
WCLIB	West Coast Lumber Inspection Bureau	www.wclib.org
WCMA	Window Covering Manufacturers Association (Formerly: AWCMA-American Window Covering Manufacturers Association)	www.windowcoverings.org
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA-National Wood Window and Door Association)	www.wdma.com
WIC	Woodwork Institute of California	www.wicnet.org
WMMPA	Wood Moulding & Millwork Producers Association	www.wmmpa.com
WWPA	Western Wood Products Association	www.wwpa.org

G. Code Agency Abbreviations and Acronyms: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the following entities. Names and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

BOCA	BOCA International, Inc.	www.bocai.org
CABO	Council of American Building Officials	(See ICC)
IAPMO	International Association of Plumbing and Mechanical Officials	www.iapmo.org
ICBO	International Conference of Building Officials	www.icbo.org
ICC	International Code Council (Formerly: CABO - Council of American Building Officials)	www.intlcode.org
SBCCI	Southern Building Code Congress International, Inc.	www.sbcci.org

H. Federal Government Agency Abbreviations and Acronyms: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the following entities. Names and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADA	Americans with Disabilities Act.	(See ADAAG)
ADAAG	Americans with Disabilities ACT (ADA) Accessibility Guidelines for Buildings and Facilities Available from Access Board	www.access.board.gov
CE	Army Corps of Engineers	CRD Standards
CFR	Code of Federal Regulations	www.access.gpo.gov/nara/cfr

CPSC	Consumer Product Safety Commission	www.cpsc.gov
CRD	Handbook for Concrete and Cement Available from Army Corps of Engineers Waterways Experiment Station	www.wes.army.mil
DOC	Department of Commerce	www.doc.gov
DOD	Department of Defense DOD Specifications and Standards	//astimage.daps.dla.mil/online
EPA	Environmental Protection Agency	www.epa.gov
FAA	Federal Aviation Administration Department of Transportation	www.faa.gov
FCC	Federal Communications Commission	www.fcc.gov
FDA	Food and Drug Administration	www.fda.gov
FED-STD	Federal Standard	(See FS)
FS	Federal Specification (Available from DOD, GSA, and NIBS)	
FTMS	Federal Test Method Standard	(See FS)
GSA	General Services Administration	www.gsa.gov
HUD	Department of Housing and Urban Development	www.hud.gov
LBL	Lawrence Berkeley Laboratory	(See LBNL)
LBNL	Lawrence Berkeley National Laboratory	www.lbl.gov
MILSPEC	Military Specification and Standards	(See DOD)
NCHRP	National Cooperative Highway Research Program	(See TRB)
NIST	National Institute of Standards and Technology	www.nist.gov
OSHA	Occupational Safety & Health Administration (See CFR 29)	www.osha.gov
RUS	Rural Utilities Service	(See USDA)
TRB	Transportation Research Board	www.nas.edu/trb
UFAS	Uniform Federal Accessibility Standards Available from Access Board	www.access-board.gov
USDA	Department of Agriculture	www.usda.gov
USPS	Postal Service	www.usps.gov

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION - (Not Used)

END OF SECTION

SECTION 01 4300

QUALITY ASSURANCE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.

1. Refer to Division 01 Section "Quality Control".

C. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.3 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.

G. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 329, and that specializes in types of tests and inspections to be performed.

H. Preconstruction Testing: Testing agency shall perform preconstruction testing for compliance with specified requirements for performance and test methods.

1. Contractor responsibilities include the following:

a. Provide test specimens and assemblies representative of proposed materials and construction. Provide sizes and configurations of assemblies to adequately demonstrate capability of product to comply with performance requirements.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Where possible fabricate and install test assemblies using installers who will perform the same tasks for Project.
d. When testing is complete, remove assemblies; do not reuse materials on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

I. Manufacturer's Field Services: An experienced authorized representative of the manufacturer to inspect field-assembled components and equipment installation, including service connections.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 4339

VISUAL MOCK-UP REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies full size mock-up requirements of building components to verify material selections, demonstrate aesthetic effects and review construction and workmanship.

B. Approved mock-up shall establish the standard by which the Work will be judged.

C. Acceptance of mock-up does not constitute approval of deviations from the Contract Documents in mock-up, unless such deviations are specifically approved by Architect in writing.

D. Retain mock-ups during construction and maintain in an undisturbed condition. Do not demolish alter or remove mock-up until approved by Architect.

E. Mock-up shall be used to demonstrate quality of materials, finish and workmanship as well as to show compliance with visual criteria.

F. Submit shop drawings prior to fabrication of visual mock-up, showing plan, elevations and details of mock-up.

PART 2 - PRODUCTS

2.1 MATERIALS

A. As specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use the same workers to do work in conjunction with construction of the mock-up as covered by the work of their respective Contracts.

B. Provide mock-up complete with corners, splice joints, control joints, sealants, and complete finish with details identical to those proposed for use in the building and as indicated on the drawings.

C. Do not use special measures or techniques, which are not representative of those to be used in the building. Finish the various components to show the maximum variation that will exist in the actual building construction between adjacent components.

D. Notify Architect when construction of mock-up begins and when major components are to be installed.

E. Complete the mock-up and obtain Architect's approval of each component of the mock-up prior to fabrication or purchase of products for the Project.

3.2 BUILDING EXTERIOR WALL

A. Fabricate and erect a visual mock-up of the typical exterior wall condition with one outside corner returning to the window line.

1. Mock-up size: As indicated on drawing elevations.

B. Provide structural steel frame work for support of visual mock-up. Frame work shall be designed by a registered professional or structural engineer licensed in the State where the Project is located.

C. Coordinate with Architect and Owner for location of mock-up on project site. When directed, demolish mock-ups and remove from Project site.

D. Construct mock-up in such a manner that each type of exterior finishes will be demonstrated in a layered fashion from one side to the other. The purpose in the layers is to facilitate the review of the multiple activities that are required to accomplish the final finish.

E. Construct mock-up in phases so that proposed construction methodologies can be observed. Mock-up shall be completely constructed, just as if it were the finished exterior wall. Wall insulation and interior wall finishes are not required.

F. In addition to specifics in the respective Specification Sections, the mock-up will be reviewed by the Owner and the Architect for the following evaluation purposes:

1. Aesthetic: To review and verify selections made under submittals, as well as to show compliance with visual criteria. Acceptance criteria is for general and specific aesthetic qualities of construction, and includes, but is not limited to, the following:

a. Color, texture, and blending of masonry units.
b. Consistency of masonry mortar color.
c. Tooling of masonry mortar joints.
d. Color, texture and finishing of exterior insulation and finish system (EIFS).
e. Tooling of sealants.
f. Color consistency of aluminum window framing.
g. Color and clarity of glass.
h. Flatness and alignment of aluminum composite material panels.

2. Installation Execution: To review and verify quality of workmanship, and compliance with Drawings, Specification and submittals. Acceptance criteria is for general and specific erection, installation and application qualities of construction, and includes, but is not limited to, the following:

a. Masonry bonding and mortar character.
b. Brick cavity cleanliness.
c. Brick cavity drainage function.
d. Masonry anchor and ties integrity.
e. Masonry flashing fabrication and embedment within the masonry.
f. Assembly of various components of the exterior insulation and finish system (EIFS), including color, texture and finishing.
g. Cold-formed metal framing fabrication and assemblage.
h. Glazed aluminum wall system fabrication, anchorage/attachment, and installation quality.

i. Glazing integrity.
j. Sealant profile consistency and bonding integrity.
k. Attachment of aluminum composite material panels.
l. Dimensional tolerances.

3.3 TYPICAL ROOM MOCK-UP

A. Arrange for the construction of a typical room mock-up located in the building, per mutual agreement between Owner and Contractor.

1. Typical Restrooms: At the first installation of a typical office restroom, complete finishes, fixtures and accessories in one restroom module as a visual mock-up.

B. The materials trades Subcontractors shall do all work in conjunction with construction of the mock-up as covered by the work of their respective Contracts.

C. Typical Room mock-up shall be complete with finishes, fixtures and details identical to those proposed for use in the Project. Do not use special measures or techniques, which are not representative of those to be used in the finish work. Finish the various components to show the quality of material and construction that will exist in the actual construction.

D. Typical room mock-up shall be of adequate size to contain all samples and demonstrate quality of materials, finish and workmanship as well as to show compliance with visual criteria. Submit shop drawings to show layout of room prior to construction. Mock-up room shall be constructed as soon as sufficient structure is available to allow installation.

E. Materials or workmanship not approved shall be removed and replaced with acceptable products or workmanship. Fabrication, purchase or installation of materials for the building shall not begin until approved in the mock-up room. Owner's approval of samples will be required on all visual items prior to any contractor's buy-out.

F. Materials installed in the room mock-up shall include an example of all furnished assemblies, hardware, equipment or accessories required for the Project and shall include, but may not be necessarily limited to the following:

1. Lavatory countertop, complete with sealant, sink, accessories, trim, etc.
2. Flush Wood veneer door
3. Hollow Metal Door Frame
4. Door Hardware
5. Ceramic floor and wall material
6. Vinyl Wall Covering(s)
7. Toilet Compartment complete with partition, side wall, pilaster, door and hardware.
8. Toilet Room Accessories
9. Water closet and trim
10. Urinal and trim
11. Lighting
12. Electrical Devices and Accessories
13. Access Doors or Panels

END OF SECTION

SECTION 01 4500

QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-control requirements for individual construction activities are specified in Division 01 Section "Structural Testing Laboratory Services".
2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-control services required by Architect or Owner are not limited by provisions of this Section.

1.2 DEFINITIONS

A. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.

B. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.

1. Refer to Division 01 Section "Quality Assurance".

C. Mock-ups: Full-size, physical example assemblies to illustrate finishes and materials. Mock-ups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Mock-ups establish the standard by which the Work will be judged.

D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.3 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.4 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Control" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

D. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Ambient conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

E. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.5 TESTING AGENCY

A. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 329, and that specializes in types of tests and inspections to be performed.

B. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.6 MOCK-UPS

A. Before installing portions of the Work requiring mock-ups, build mock-ups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-ups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect 15 days in advance of dates and times when mock-ups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
5. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mock-ups when directed, unless otherwise indicated to be incorporated into the work.

1.7 QUALITY CONTROL

A. Design Professional Responsibilities: Where quality-control services within individual Sections are indicated as Design Professional's responsibility, Design Professional will engage a qualified testing agency to perform these services.

1. Design Professional will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of the types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Special Tests and Inspections: Design Professional will engage a testing agency to conduct special tests and inspections.

1. Testing agency will notify Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor.
3. Testing agency will submit a final report of special tests and inspections at Material Completion, which includes a list of unresolved deficiencies.
4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Testing agency will retest and reinspect corrected work.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
5. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field-curing of test samples.
5. Delivery of samples to testing agencies where specified.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule concurrently with Contractor's Construction Schedule.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.

2. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 01 4529

STRUCTURAL TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-01 Specification Sections apply to work specified in this Section.

1.2 SCOPE OF WORK

A. The Design Professional's Testing Laboratory: An independent testing laboratory will sample and test materials as they are being installed for compliance with acceptance criteria as specified and report and interpret the results. The laboratory shall monitor and report on the installation of constructed work and shall perform tests on the completed construction as required to indicate Contractor's compliance with the various material specifications governing this work. The Design Professional shall be responsible for paying the testing laboratory for these services.

B. The Contractor shall not engage the same testing laboratory for construction services as the Design Professional has for quality assurance testing, unless agreed to by the Design Professional.

1.3 SPECIAL INSPECTIONS

A. The Design Professional's Testing Laboratory or a separate agency shall serve as a Special Inspector to provide Special Inspection services for the items listed below. The scope of such services for each item shall be as defined in the International Building Code – 2006 and as included in the 'Schedule of Special Inspections' as prepared by the Design Professional. These inspections are mandatory for conformance to the legal requirements of the building code and shall be in addition to the inspections and tests otherwise defined in this specification.

1. Reinforcing Steel Placement
2. Concrete Work
3. Bolts to be Installed in Concrete and Their Installation to allow for higher allowable tension values
4. Inspection of Structural Steel, Bolting, and Welding Material
5. Welding of Structural Steel
6. High-Strength Bolting
7. Spray-Applied Fire-Resistive Materials
8. Prepared Earth Fill

9. Masonry Work

B. Qualifications of Special Inspector: The special inspector shall be a qualified person who shall demonstrate competence, to the satisfaction of the Design Professional and in accordance with GSFIC Guidelines, for inspection of the particular type of construction or operation being inspected. The Special Inspector shall meet the legal qualifications of the building code having jurisdiction.

C. Duties and Responsibilities of the Special Inspector:

1. The special inspector shall observe the work assigned to ascertain, to the best of his/her knowledge, that it is in conformance with the approved design drawings and specifications.

2. The special inspector shall furnish inspection reports to the Design Professional. All discrepancies shall be brought to the immediate attention of the Design Professional, and Contractor. A report that the corrected work has been inspected shall be sent to the Design Professional.

3. The special inspector shall submit a final signed report stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance to the approved plans and specifications and the applicable workmanship provisions of the building code.

1.4 QUALIFICATIONS OF TESTING LABORATORY

A. The Testing Laboratory shall meet the basic requirements of ASTM E329 and shall submit to the Design Professional evidence of current accreditation from the American Association for Laboratory Accreditation, the AASHTO Accreditation Program or the "NIST" National Voluntary Laboratory Accreditation Program.

B. The Testing Laboratory shall be an Approved Agency by the GFSIC to perform Special Inspections and other tests and inspections as outlined in the applicable building code.

C. Tests and inspections shall be conducted in accordance with specified requirements, and if not specified, in accordance with the applicable standards of the American Society for Testing and Materials or other recognized and accepted authorities in the field.

D. Qualifications of Welding Inspectors

1. Inspectors performing visual weld inspection shall meet the requirements of AWS D1.1 Section 6.1.4. Welding inspection shall be supervised and the inspection reports signed by an inspector with current certification as an AWS Certified Welding Inspector (CWI)

2. Inspectors performing nondestructive examinations of welds other than visual inspection (MT, PT, UT, RT) shall meet the requirements of AWS D1.1, Section 6.14.6.

3. Alternately, Welding Inspectors may be an ICC Structural Welding Special Inspector.

1.5 AUTHORITIES AND DUTIES OF THE LABORATORY

A. Attending Preconstruction Conferences: The Design Professional's Testing Laboratory shall receive from the Design Professional and review the project plans and specifications with the Design Professional as soon as possible prior to the start of construction. The Laboratory shall attend preconstruction conferences with the Design Professional, Project Manager, General

Contractor, and Material Suppliers as required to coordinate materials inspection and testing requirements with the planned construction schedule and shall participate in such conferences throughout the course of the project.

B. Cooperation with Design Team: The Laboratory shall cooperate with the Design Professional, and Contractor and provide qualified personnel promptly on notice.

C. The Laboratory shall perform the required inspections, sampling, and testing of materials as specified under each section and observe methods of construction for compliance with the requirements of the Contract Documents and the applicable building code.

D. Inspections Required by Government Agencies: The Testing Laboratory shall perform inspections and submit reports and certifications as required by government agencies having jurisdiction over the aspects of the project covered by this specification.

E. Notification of Deficiencies in the Work: The Laboratory shall notify the Design Professional, and Contractor within 24 hours of discovery by telephone or e-mail, and then in writing of observed irregularities and deficiencies of the work and other conditions not in compliance with the requirements of the Contract Documents.

F. Reports:

1. Information on Reports: The Laboratory shall submit copies of reports of inspections and tests promptly and directly to the parties named below. The reports shall contain at least the following information:

    a. Project Name
    b. Date report issued
    c. Testing Laboratory name and address
    d. Name and signature of inspector
    e. Date of inspection and sampling
    f. Date of test
    g. Identification of product and Specification section
    h. Location in the project
    i. Identification of inspection or test
    j. Record of weather conditions and temperature (if applicable)
    k. Results of test regarding compliance with Contract Documents

2. Copies: The Laboratory shall send signed copies of test and inspection reports to the following parties:

    a. 2 copies to the General Contractor
    b. 2 copies to the Design Professional
    c. 1 copy to Owner

3. Certification: Upon completion of the job, the Laboratory shall furnish to the Design Professional, a Final Report of Special Inspections statement signed by a licensed professional engineer that, to the best of their knowledge, required tests and inspections were made in accordance with the requirements of the Contract Documents.

G. Accounting: The Testing Laboratory shall be responsible for separating and billing costs attributed to the Design Professional and costs attributed to the Contractor.

H. Monitoring Product and Material Certifications: The Testing Laboratory shall be responsible for monitoring the submittals of product and material certifications from manufacturers and

suppliers as specified in the Specifications and shall report to the Design Professional when those submittals are not made in a timely manner.

I. Limitations of Authority: The Testing Laboratory is not authorized to revoke, alter, relax, enlarge upon, or release any requirements of the Specifications or to approve or accept any portion of the work or to perform any duties of the General Contractor and his Subcontractors.

1.6 CONTRACTOR'S RESPONSIBILITY

A. Contractor shall provide a 'Contractor's Statement of Responsibility' for the seismic elements of the structure.

B. Cooperation with Design Team: The Contractor shall cooperate with laboratory personnel, provide access to the work, and to manufacturer's operations.

C. Furnishing Samples and Certificates: The Contractor shall provide to the laboratory certificates and representative samples of materials proposed for use in the work in quantities sufficient for accurate testing as specified.

D. Furnishing Casual Labor, Equipment and Facilities: The Contractor shall furnish casual labor, equipment, and facilities as required for sampling and testing by the laboratory and otherwise facilitate the required inspections and tests.

E. Advance Notice: The Contractor shall be responsible for notifying the Testing Laboratory sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests. Failure to sufficiently notify may result in additional costs incurred by the Testing Laboratory that may be back-charged to the Contractor by the Design Professional.

F. Payment for Substitution Testing: The Contractor shall arrange for and pay for any additional samples and tests above those required by the Contract Documents as requested by the Contractor for his convenience in performing the work.

G. Payment for Retesting: The Contractor shall be liable to the Design Professional for the cost for any additional inspections, sampling, testing, and retesting done by the Design Professional's Testing Laboratory as required when initial tests indicate work does not comply with the requirements of the Contract Documents.

H. Payment by Contractor: The Contractor shall furnish and pay for the following items if required:

1. Soil survey of the location of borrow soil materials, samples of existing soil materials, and delivery to the Contractor's Testing Laboratory.

2. Samples of concrete aggregates and delivery to the Contractor's Testing Laboratory.

3. Concrete mix designs as prepared by his concrete supplier.

4. Site-situated storage boxes for concrete cylinders

5. Concrete coring, tests of below strength concrete, and load tests, if ordered by the Design Professional.

6. Certification of structural steel mill order.

7. Certification of portland cement, lime, fly ash.

8. Certification of welders and preparation of Welding Procedure Specifications.

9. Tests, samples, and mock-ups of substitute material where the substitution is requested by the Contractor and the tests are necessary in the opinion of the Design Professional to establish equality with specified items.

10. The making and testing of concrete cylinders for the purpose of evaluating strength at time of form stripping or for post-tensioning or the time spent evaluating the in situ strength of concrete using the Maturity Method.

11. Any other additional tests when such costs are required by the Contract Documents to be paid by the Contractor.

I. Notification of Source Change: The Contractor shall be responsible for notifying the Design Professional, and Design Professional's Testing Laboratory when the source of any material is changed after the original tests or inspections have been made.

J. Tests for Suspected Deficient Work: If in the opinion of the Design Professional any of the work of the Contractor is not satisfactory, the Contractor shall furnish and pay for all tests that the Design Professional deem advisable to determine its proper construction. The Design Professional shall pay all costs if the tests prove the questioned work to be satisfactory.

1.7 PAYMENT OF TESTING LABORATORY

A. The Design Professional will pay for the initial Laboratory services for testing of materials for compliance with the requirements of the Contract Documents. The Contractor will be liable to the Design Professional for the cost for testing and retesting of materials that do not comply with the requirements of the Contract Documents and shall furnish and pay for the testing and inspection of other items as specified in these Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCOPE OF WORK

A. The work to be performed by the Testing Laboratory shall be as specified in this Section of the Specification and as determined in meetings with the Design Professional.

3.2 EARTHWORK

A. Compacted Fill Inspection and Testing:

1. Inspection of Subgrade Below Compacted Fill: The Design Professional's Testing Laboratory shall observe and verify that the subgrade below compacted fill has been properly prepared before compact fill construction begins.

2. Verification of Fill Material: Perform classification and testing to verify that the fill material to be used complies with the project specifications.

3. During placement and compaction of fill, determine that the material being used and the maximum lift thickness comply with the specifications.

4. Field Density Testing: Perform field density testing as described below

a. Paved Areas and Building Slab Subgrade:
   (1) Make at least one field density test of the natural subgrade for every 2500 square feet of paved area or building slab but in no case less than three tests.
   (2) In each compacted fill layer or lift, make one field density test for every 2500 square feet of building slab or paved area but in no case less than three tests.

b. Foundation Wall Backfill: Make at least one field density test for each 200 lineal feet of wall with a minimum of 4 tests for the basement walls around the perimeter of each building and a minimum of one test for every other type of foundation wall on the site. Tests shall be performed in random lifts along each wall.

c. Compacted Fill Beneath Column and Wall Footings and Mat Foundations: Make at least one field density test in each compacted fill layer or lift for each column footing, one for each twenty-five lineal feet of wall and one for each 2500 sq. ft of mat foundation area or fraction thereof.

5. Field Density Tests: Field Density Tests shall be run according to ASTM D2937, or ASTM D6938 as applicable.

6. Acceptance Criteria: All field density tests must meet the required density.

7. Report Copies: Moisture-density curves and results of field density tests shall be submitted to the parties specified earlier in this section.

8. Additional Testing: If reports by the Laboratory indicate field densities lower than specified, additional tests will be run by the Laboratory with at least the frequencies scheduled above on recompacted fill and/or natural subgrade. The Testing Laboratory shall notify the Contractor on a timely basis for any required retesting so as not to delay the work. The costs of such tests shall be liable to the Design Professional for repayment by the Contractor.

B. Foundation Inspection by the Testing Laboratory:

1. Material Testing: The Design Professional's Testing Laboratory shall provide testing and inspection of materials used in foundation elements as described below.

2. Spread (Excavated) Footings

a. Concrete Cylinders: Make and test concrete cylinders as specified for Poured-in-Place Concrete.
b. Reinforcing Steel: Inspect reinforcing steel size, number of bars, and placement and confirm dowel or anchor bolt placement into footing.

3.3 REINFORCING STEEL

A. Reinforcing Steel Field Inspection: The Design Professional's Testing Laboratory or designated Special Inspector shall inspect 100 % of reinforcement before each concrete pour to verify the information noted below. Inspection reports shall be prepared and distributed as specified in this specification.

1. Primary and secondary, longitudinal reinforcement has correct size and number in proper layers.

2. Longitudinal reinforcement has correct length and lap.

3. Ties and stirrups are of correct size, spacing, and number and have the proper termination-hook geometry.

4. Proper hooks are provided at bar ends as detailed.

5. Reinforcement is properly supported and braced to formwork to prevent movement during concreting operation.

6. Reinforcement has proper cover.

7. Sufficient spacing between reinforcement for concrete placement.

8. Dowel reinforcement is of proper size, at proper spacing, and has proper lap length and embedment length.

9. Welded wire reinforcement is composed of flat sheets, has proper wire gage and spacing, is properly supported, and is properly lapped with a length of one square plus two inches.

10. Proper Construction/Control/Expansion joint spacing and reinforcement.

11. Reinforcement around embedded items is erected according to details.

12. Welded reinforcement has been done according to AWS requirements. Review the Welding Procedure Specification (WPS) submitted by the contractor for any reinforcing steel other than ASTM A 706 that is proposed to be welded for consistency with acceptable welding practices and the AWS.

3.4 CONCRETE MATERIALS AND POURED IN PLACE CONCRETE

A. Concrete Mix Designs: The Design Professional's Testing Laboratory shall review the submitted mix designs for conformance to the specifications and for suitability for use in the project. The Testing Laboratory shall attend the Mix Design Conference and the Pre-Concrete Conference as noted in the Cast-in-Place Concrete Specification.

B. Job Site Inspection: The scope of the work to be performed by the inspector on the jobsite shall be as follows:

1. Prior to Concrete Placing

a. Spread Footings
   (1) Verify footing dimension.
   (2) Verify top of footing elevation.
   (3) Verify that forms are plumb and straight, braced against movement, and lubricated for removal.
   (4) Inspect reinforcement per REINFORCING STEEL section.

b. Slab-on-Grade
   (1) Verify that moisture retarder is provided, is lapped properly, and is not torn or punctured.
   (2) Verify formwork at turndowns and slab edges is plumb and straight, braced against movement and lubricated for removal.
   (3) Inspect reinforcement per REINFORCING STEEL section.
   (4) Verify there is no standing water or debris in pour area.

c. Elevated Deck (General)
   (1) Verify that the slab thickness and top-of-slab elevation is correct.

(2) Verify that openings and sleeves are correct size and location.
(3) Inspect reinforcement per REINFORCING STEEL section.
(4) Verify that debris is removed.

2. On-Site Concrete Material Testing and Inspection

a. Verify that the Contractor is following appropriate concreting practices consistent with any extreme environmental conditions at the point of placement in the structure as defined below.
b. Inspect concrete upon arrival to verify that the proper concrete mix number, type of concrete, concrete strength, and that it is meeting job specifications, is being placed at the proper location. Report concrete not meeting the specified requirements and immediately notify the Contractor, Batch Plant Inspector and Design Professional.
c. Inspect plastic concrete upon arrival at the jobsite to verify proper batching. Observe mix consistency and adding of water as required to achieve target slumps in mix designs. Record the amount of water added and note if it exceeds that allowed in the mix design. The responsibility for adding water to trucks at the job site shall rest only with the Contractor's designated representative. The Contractor is responsible that all concrete placed in the field is in conformance to the Contract Documents.
d. Obtain concrete test cylinders as specified below.
e. Perform tests to determine slump, concrete temperature, unit weight, and air entrainment as specified below. The slump tests shall be made on concrete taken from the same location from which the concrete for the test cylinders is obtained.
f. Record information for concrete test reports as specified below.
g. Pick up and transport to Laboratory, cylinders cast the previous day.

3. After Concrete Floor Placing and Finishing

a. Verify that the curing process is according to specifications and that any curing compound used is applied in accordance with manufacturer's recommendations.

4. The job site inspector shall report any irregularities that occur in the concrete at the job site or test results to the Contractor, and Design Professional.

C. Concrete Test Cylinders: The Design Professional's Testing Laboratory shall mold and test concrete test cylinders as described below.

1. Cylinder Molding and Testing: Cylinders for strength tests shall be molded and Laboratory cured in accordance with ASTM C31 and tested in accordance with ASTM C39.

2. Field Samples: Field samples for strength tests shall be taken in accordance with ASTM C172.

3. Frequency of Testing: Each set of test cylinders shall consist of a minimum of four standard test cylinders. A set of test cylinders shall be made according to the following minimum frequency guidelines:

a. One set for each class of concrete taken not less than once a day.
b. Spread Footings: One set for each 50 cubic yards or fraction thereof.
c. Basement Walls: One set for each 100 cubic yards.
d. Floors: One set for each **100** cubic yards or fraction thereof but not less than one set for each 5000 square foot of floor area.

e. All Other Concrete: A minimum of one set for each 100 cubic yards or fraction thereof.
f. No more than one set of cylinders at a time shall be made from any single truck.
g. If the total volume of concrete is such that the frequency of testing as specified above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.
h. The above frequencies assume that one batch plant will be used for each pour. If more than one batch plant is used, the frequencies cited above shall apply for each plant used.

4. The cylinders shall be numbered, dated, and the point of concrete placement in the building recorded.

5. For concrete specified on the drawings to reach the required strength at 28 days, break one of the four cylinders of the set at seven days, two at 28 days, and one at 56 days.

6. Cylinder Storage Box: The Contractor shall be responsible for providing a protected concrete cylinder wooden storage box at a point on the job site mutually agreeable with the Testing Laboratory for the purpose of storing concrete cylinders until they are transported to the Laboratory. The box shall be constructed and equipped to maintain the environment specified for initial curing in ASTM C31.

7. Transporting Cylinders: The Design Professional's Testing Laboratory shall be responsible for transporting the cylinders to the Laboratory in a protected environment such that no damage or ill effect will occur to the concrete cylinders including loss of moisture, freezing temperatures or jarring.

8. Information on Concrete Test Reports: The Design Professional's Testing Laboratory shall make and distribute concrete test reports after each job cylinder is broken. Such reports shall contain the following information:

a. Truck number and ticket number
b. Concrete Batch Plant
c. Mix design number
d. Accurate location of pour in the structure
e. Strength requirement
f. Date cylinders made and broken
g. Technician making cylinders
h. Concrete temperature at placing
i. Air temperature at point of placement in the structure
j. Amount of water added to the truck at the batch plant and at the site and whether or not it exceeds the amount allowed by the mix design
k. Slump
l. Unit weight
m. Air content
n. Cylinder compressive strengths with type of failure if concrete does not meet Specification requirements. Seven day breaks are to be flagged if they are less than 60% of the required 28 day strength. 28 day breaks are to be flagged if either cylinder fails to meet Specification requirements.

9. Standards for Tests of Concrete :

a. Slump Tests: Slump Tests (ASTM C143) shall be made at the beginning of concrete placement for each batch plant and for each set of test cylinders made. The slump test shall be made from concrete taken from the end of the concrete

truck chute. The concrete shall be considered acceptable if the slump is within plus or minus 1 inch of the slump noted on the mix design submittal form for that class of concrete.

b. Air Entrainment: Air entrainment tests (ASTM C231 or C173, C173 only for lightweight concrete) shall be made at the same time slump tests are made as cited above.

c. Concrete Temperature: Concrete temperature at placement shall be measured (ASTM C1064) at the same time slump tests are made as cited above.

d. Unit Weight Test: ASTM C138

10. Evaluation and Acceptance of Concrete:

a. Strength Test: A strength test shall be defined as the average strength of two cylinder breaks from each set of cylinders tested at the time indicated above.

b. Quality Control Charts and Logs: The Design Professional's Testing Laboratory shall keep the following quality control logs and charts for each class of concrete containing more than 2,000 cubic yards. The records shall be kept for each batch plant and submitted on a weekly basis with cylinder test reports:

(1) Number of strength tests made to date.

(2) Strength test results containing the average of all strength tests to date, the high test result, the low test result, the standard deviation, and the coefficient of variation.

(3) Number of tests under specified strength.

(4) A histogram plotting the number of strength test cylinders versus compressive strength.

(5) Quality control chart plotting compressive strength test results for each test.

(6) Quality control chart plotting moving average for strength where each point plotted is the average strength of three previous test results.

(7) Quality control chart plotting moving average for range where each point plotted is the average of 10 previous ranges.

c. Acceptance Criteria: The strength level of an individual class of concrete shall be considered satisfactory concrete tests meet or exceed the specified f'c.

d. If either of the above requirements is not met, the Testing Laboratory shall immediately notify the Design Professional by telephone. Steps shall immediately be taken to increase the average of subsequent strength tests.

D. Investigation of Low Strength Concrete Test Results:

1. Cost of Investigations for Low Strength Concrete: The Contractor shall reimburse the Design Professional for the costs of investigations of low strength concrete, as defined above.

2. Scope of Investigations: See Specification Section 03300, Cast-In-Place Concrete, for the investigations that may be required by the Design Professional. The Design Professional's Testing Laboratory will conduct these investigations.

E. Causes for Rejection of Concrete: The Contractor shall reject concrete delivered to the site for any of the following reasons:

1. Wrong class of concrete (incorrect mix design number).

2. Environmental Conditions: Environmental condition limits shall be as follows unless appropriate provisions in concreting practices have been made for cold or hot weather:

a. Cold Weather: Air temperature must be 40°F and rising or the average daily temperature cannot have been lower than 40°F for 3 consecutive days unless the temperature rose above 50°F for at least one-half of any of those 24 hour periods.
b. Hot Weather: Environmental conditions must be such that cause an evaporation rate from the concrete surface of 0.2 lb./sq. ft./hr. or less as determined by Figure 2.1.5 in ACI 305R-91.

Concrete may be placed at other environmental condition ranges only with approval of the job inspector for the Design Professional's Testing Laboratory or other duly appointed representative.

3. Concrete with temperatures exceeding 95°F shall not be placed in the structure.

4. Air contents outside the limits specified in the mix designs.

5. Slumps outside the limits specified.

6. Excessive Age: Concrete shall be discharged within 90 minutes of plant departure or before it begins to set if sooner than 90 minutes unless approved by the Laboratory job inspector or other duly appointed representative.

F. Concrete Batch Trip Tickets: Concrete batch trip tickets shall be collected and retained by the Contractor. Compressive strength, slump, air, and temperature tests shall be identified by reference to a particular trip ticket. Tickets shall contain the information specified in ASTM C94. Each ticket shall also show the amount of water that may be added in the field for the entire batch that will not exceed the specified water cement ratio for the design mix. The Contractor and Design Professional's Testing Laboratory shall immediately notify the Design Professional and each other of tickets not meeting the criteria specified.

3.5 STRUCTURAL STEEL

A. Contract Obligations:

1. Design Professional Responsibility: The Design Professional shall pay for initial shop and field inspections and tests as required during the fabrication and erection of the structural steel.

2. Testing Laboratory Responsibility: The inspection by the Design Professional's Testing Laboratory of the Fabricator's work shall be in sequence, timely, and performed in such a manner so that corrections can be made without delaying the progress of the work. Inspections shall be performed by qualified technicians with a minimum of two years experience in structural steel testing and inspection. See "Qualifications of Testing Laboratory" section for special requirements for welding inspectors. The Testing Laboratory shall provide test reports of inspections. All test reports shall indicate types and locations of defects found during inspection, the measures required and performed to correct such defects, statements of final approval of welding and bolting of shop and field connections, and other fabrication and erection data pertinent to the safe and proper welding and bolting of shop and field connections. In addition to the parties listed in this Specification the Fabricator and Erector shall receive copies of the test reports.

3. Rejection of Material or Workmanship: The Design Professional, reserves the right to reject any material or workmanship not in conformance with the Contract Documents at any time during the progress of the work. However, this provision does not allow waiving the obligation for timely, in sequence inspections.

B. Shop Inspection and Testing: The Design Professional's Testing Laboratory shall provide the following inspections at the designated fabrication shops:

1. Fabricators Certificate of Compliance: The requirement to perform fabricating shop inspection may be waived if the Fabricator produces a "Fabricators Certificate of Compliance", a copy of the shop certification from AISC or building code evaluation services report.

2. An initial shop inspection prior to the start of any fabricating work shall be made to accomplish the following:

   a. Verify the fabrication shop's certification from AISC.
   b. Verify that the fabricator's fabrication and quality control procedures provide a sound basis for inspection control of workmanship and of the ability to conform to construction documents and industry standards. Review the procedures for completeness and adequacy relative to code requirements for the fabricator's finished product.
   c. Perform steps 1, 2 and 3 of welding inspection duties described below in "Weld Inspection and Testing" when shop welding is to be performed.
   d. Perform step 1 of bolt inspection duties described below in "High-strength Bolting Inspection and Testing" when shop bolting involves joints that are designated on the plans as "Pretensioned" or "Slip-Critical".
   e. Provide periodic verification of specified camber of steel beams.

3. Process Monitoring:

   a. Provide continuous monitoring of welding for all CJP,PJP, Multipass fillet welds and Single-pass fillet welds greater than 5/16 inch as described below in the Weld Inspection and Testing section.
   b. Periodically monitor welding of single-pass fillet welds that are less than or equal to 5/16 inch.
   c. Provide continuous monitoring of high-strength bolt installation in pre-tensioned or slip-critical joints using turn-of-the-nut without matchmarking or calibrated wrench method of bolt installation.

C. Field Inspections: The Design Professional's Testing Laboratory shall provide the following inspections in the field:

1. Obtain the planned erection procedure, and review with the Erectors supervisory personnel.

2. Check the installation of base plates for proper leveling, grout type, and grout application.

3. Check structural steel and cold-formed steel deck as received in the field for possible shipping damage, workmanship, and identification marking to conform to AISC 360 for structural steel and as specified ASTM standards for other steel and steel deck.

4. Verify that surveys are occurring as specified to check plumbness and frame alignment as erection progresses. Review the submitted survey report.

5. Conduct welding inspection and verification testing per detailed requirement of section D-Welding Inspection and Testing below.

6. Conduct high-strength bolting inspection per detailed requirements of Section E – High-Strength Bolting and Testing below.

7. Periodically inspect the steel frame joint details such as bracing and stiffening, member locations, and connection details for compliance with approved construction documents.

8. Inspect 100% of the column compression and base joints for verification that gaps in contact bearing do not exceed 1/16 inch. Gaps greater than 1/16 inch but less than 1/4 inch shall be reported to the Design Professional for assessment. All gaps greater than 1/4 inch shall be shimmed with non-tapered mild steel shims.

9. Endeavor to guard the Design Professional against the Contractor cutting, grinding, reaming, or making any other field modification to structural steel without the prior approval of the Design Professional. Report any noted unauthorized modifications to the Design Professional.

D. Weld Inspection and Testing: The Design Professional's Testing Laboratory shall make the following inspections and tests of the welds and welding processes. Welds performed in the fabricating shop may be inspected in the field unless continuous monitoring of the welding process is herein specified or if access in the field due to other work or shop finishes makes field inspection impractical:

1. Approve Welding Procedure Specifications submitted by the Contractor. Approve any changes submitted by the Contractor to any WPS that has already been approved. Obtain the Welding Procedure Qualification Record (WPQR) for each successful WPS qualification.

2. Verify welder qualifications either by certification and/or by retesting. Obtain welder certificates.

3. Verify welding electrodes to be used and other welding consumables as the job progresses.

4. Periodically observe joint preparation, assembly practice, welding techniques including preheating and sequence, and the performance of welders with sufficient frequency to assure compliance with code and contract document requirements. Check preheating to assure conformance with AWS D1.1, Section 5.6. Verify procedure for control of distortion and shrinkage stresses.

5. Observe joint preparation and fit up, backing strips, and runout plates for welded moment connections and column splices.

6. Continuous visual inspection of the root pass of partial and complete joint penetration welds.

7. Visually inspect 100% of the welding or other attachment method of steel deck to the structure.

8. Visually inspect 100% of completed shear connectors in each beam and perform bend tests as required according to inspection procedures outlined in AWS D1.1. In addition, perform field bend tests on an additional 2% of completed shear connectors in each beam but not less than one connector per beam

9. Visually inspect 100% of the welds of anchors to embedded plates that are to be cast into concrete elements.

10. Weld Verification Testing Scope:

a. Perform nondestructive examination services using a qualified technician with the necessary equipment to perform the following:
   (1) Nondestructive examination conducted in accordance with the specific requirements for the item being examined including radiographic (RT), ultrasonic (UT), magnetic particle (MT), or dye-penetrant inspection (PT). Nondestructive inspection procedures shall conform to AWS D1.1.
   (2) Interpret, record, and report results of the nondestructive tests.
   (3) Mark for repair, any area not meeting Specification requirements. Correction of rejected welds shall be made in accordance with AWS D1.1.
   (4) Re-examine repair areas and interpret, record, and report the results of examinations of repair welds.
   (5) Verify that quality of welds meet the requirements of AWS D1.1..

b. Fillet welds. provide the following:
   (1) UT test a minimum of 10% of the length of each fillet weld exceeding 5/16".
   (2) Increase UT testing rate for welders having a high rejection rate as required to ensure acceptable welds.

c. Partial joint penetration welds, including flare-bevel groove welds. provide the following:
   (1) MT test a minimum of 25% of the length of each PJP weld exceeding 5/16" effective throat.
   (2) Periodic MT testing of representative PJP welds 5/16" and less but need not exceed 10% of all such welds, except as provided in (3) below.
   (3) Increase MT testing rate for welders having a high rejection rate as required to ensure acceptable welds.

d. Complete joint penetration welds. provide the following:
   (1) All CJP welds exceeding 5/16" thickness shall be 100% UT tested per AWS D1.1 Chapter 6 Part F. The testing laboratory shall review the CJP joints to determine where geometry or accessibility precludes the use of standard scanning patterns per AWS D1.1 Chapter 6 Part F. At these locations the testing laboratory shall develop and submit for approval a written testing procedure in accordance with AWS D1.1 Annex K.
   (2) Periodic MT testing of representative CJP welds 5/16" and less not to exceed 10% of all such welds, except as provided in (3) below.
   (3) Increase MT testing rate for welders having a high rejection rate as required to ensure acceptable welds.

e. Base metal thicker than 1.5 inches, where subjected to through-thickness weld shrinkage strains, shall be UT tested for discontinuities behind and adjacent to such welds. UT testing shall occur no sooner than 24 hours after the weld has cooled to ambient temperatures. Any material discontinuities shall be recorded on the basis of ASTM A435 or ASTM A898 (Level 1 criteria) and reported for Design Professional disposition.

f. Welds of Anchors to Embedded Plates:
   (1) Headed Studs: Perform field bend tests according to AWS D1.1 on 2% of the studs welded to plates, but not less than one stud per plate.
   (2) Deformed Bar Anchors: Perform MT testing on 10% of deformed bar anchors larger than #5 bar.

g. The costs of repairing defective welds and the costs of retesting by the Testing Laboratory providing services for the Design Professional shall be borne by the Contractor. If removal of a backing strip is required by the Testing Laboratory to investigate a suspected weld defect, such cost shall be borne by the Contractor.

E. High-Strength Bolting Inspection and Testing: The Design Professional's Testing Laboratory shall perform the following inspections and test for connections joined with high-strength bolting. Bolting performed in the shop may be inspected in the field unless continuous monitoring of the bolting operation is herein specified:

1. Observe preinstallation verification testing of the pretensioning method to be used in accordance with the requirements of the "Specification for Structural Joints Using ASTM A325 and A490 Bolts". Daily check the calibration of impact wrenches used in field bolted connections.

2. Inspect bolt installation for 100% of high strength bolted connections according to inspection procedures outlined in the "Specification for Structural Joints Using ASTM A325 or A490 Bolts".

3. Perform Arbitration Testing and Inspection according to procedures outlined in the "Specification for Structural Joints using ASTM A325 or A490 Bolts" when a disagreement exists between the Testing Laboratory and the Fabricator as to the minimum tension of installed bolts that have been inspected according to paragraph above.

4. Monitoring of Bolting Installation:

   a. Continuous Monitoring: The Design Professional's Testing Laboratory shall be continuously present and monitor the bolting installation for compliance with the selected procedure for installation as specified in the "Specification for Structural Joints Using ASTM A325 and A490 Bolts" for joints using high-strength bolts that are designated on the plans as Pretensioned (PT) or Slip-Critical (SC) type joints and that are being installed using the calibrated wrench method or the turn-of-nut without matchmarking method of installation.
   b. Periodic Monitoring: All other joint types and bolt installation methods may be monitored on a periodic basis.

3.6 NON-SHRINK GROUT FOR BASE PLATES, BEARING PLATES AND PRECAST WALL PANELS

A. Compressive Strength Tests (by the Design Professional's Testing Laboratory): Compressive strength of grout shall be determined by testing grout cubes according to the requirements of ASTM C109 - Modified. Test one set of three cubes at 1 day, and one set of three cubes at 28 days.

B. Frequency of Testing: One set of cubes (6 cubes) shall be made for every ten base plates and bearing plates or fraction thereof but not less than one set for each day's operation. One set of cubes shall be made for each day's operation of grouting wall panels.

3.7 MASONRY

A. Verification Testing Frequency: Verification of masonry strength (f'_m) will be performed at the beginning of masonry construction.

B. Concrete Masonry Unit: For each type of concrete masonry unit indicated, verify compliance with ASTM C90 and the strength required by design. Verification may be by reviewing certification from unit producer showing compliance.

C. Mortar:

   1. As construction begins, verify the proportions of the site-prepared mortar mix comply with the requirements of ASTM C270 for the type specified.

D. Grout:

1. Prior to grouting, verify the proportions of site-prepared grout mix comply with the requirements of ASTM C476 for each type of grout used.

2. Report test results in writing and in form specified under each test method, to Design Professional and Contractor, on same day tests are made.

3. Retests: Where prism tests indicate non-compliance with specified requirements, additional testing shall be performed at the frequency of two additional tests for each unsatisfactory test. The cost of such additional testing shall be the responsibility of the Contractor. Where retesting fails to indicate conformance with specified requirements, any masonry construction represented by unsatisfactory tests shall be removed and replaced with acceptable masonry construction.

E. Mortar Joints: As construction begins, verify that mortar joints are being prepared in accordance with these specifications and ACI 530.1/ASCE 6/TMS 602.

F. Reinforcement and Connectors: Prior to grouting, verify the size, grade, type and placement of reinforcement and connectors is in compliance with specified requirements.

G. Grouting: Prior to any grouting procedure, the grout space shall be inspected to verify that it is clean and that cleanouts, if required, are in place and conform to requirements. Verify through continuous inspection that the placement of grout is in compliance with the requirements of the contract specifications and ACI 530.1/ASCE 6/TMS 602.

H. Anchors: Periodically verify the type, size and location of anchors including anchors of masonry to other structural members, frames, or construction is in compliance with specified requirements.

I. Installed items: Verify that installed flashing, weep holes, construction joints, control joints and wall vents are installed in accordance with specifications.

3.8 OPEN WEB STEEL JOISTS

A. Scope: The Design Professional's Testing Laboratory shall perform inspection of open web steel joists as herein described.

B. Field Inspection: The duties of the Design Professional's Testing Laboratory shall be as follows:

1. Visually inspect a representative sample of joist shop welds not to exceed 10% of such welds, for compliance with SJI specifications. Increase inspection frequency if inspected welds incur a high rejection rate.

2. Visually inspect 100% of welded chord splices for compliance with SJI and project specifications.

3. Inspect joists for damage during shipment.

4. Verify proper bearing of joist supports.

5. Verify camber requirements of joists arriving in the field.

6. Confirm bridging size and location.

7. Review field welder qualifications by certification or verify by retesting. Obtain welder certificates.

8. Visually inspect 100% of field attachment of joists to supports (welding or bolting).

9. Perform Magnetic Particle testing (MT) on representative field welds not to exceed 10% of such welds unless rejection rates become high, in which case, frequency inspection shall be increased to ensure acceptable welding.

10. Confirm bolting of joists to supports at column lines as required by OSHA requirements.

11. Verify that no joists have been damaged during erection.

3.9 POST INSTALLED ANCHORS

A. Scope: The Design Professional's Testing Laboratory shall perform inspection of all post installed anchor installation. Verify that all post-installed anchors have an approved Evaluation Service Report (ESR) and are installed in accordance with the instruction in that report.

B. Field Inspection. The duties of the Design Professional's Testing Laboratory shall be as follows:

1. Visually Inspect all installations.

2. Continuously inspect installation of all adhesive anchors.

3. Perform periodic inspection of other anchor installation.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including but not limited to, the following:

1. Temporary roads and paving.
2. Dewatering facilities and drains.
3. Waste disposal facilities.
4. Field offices.
5. Storage and fabrication sheds.
6. Lifts and hoists.
7. Temporary elevator usage.
8. Temporary stairs.
9. Construction aids and miscellaneous services and facilities.
10. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.

B. Temporary utilities are specified in Division 01 Section "Temporary Utilities".

C. Security and protection facilities are specified in Division 01 Section "Temporary Barriers and Enclosures."

1.2 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.3 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:

1. Testing agencies.
2. Personnel of authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws, including but not limited to, the following:

1. Building Code requirements.
2. Health and safety regulations.
3. Utility company regulations.
4. Police, Fire Department and Rescue Squad rules.

5. Environmental protection regulations.
6. City ordinances and regulations.

1.5 PROJECT CONDITIONS

A. Temporary Facilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary facilities to use of permanent facilities.

1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:

1. Keep temporary services and facilities clean and neat.
2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials and equipment may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

2.2 EQUIPMENT

A. General: Provide equipment suitable for use intended.

B. Field Offices: Prefabricated with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading.

C. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

D. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY FACILITIES INSTALLATION

A. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.

1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
2. Temporary Toilets: Install self-contained toilet units. Shield toilets to ensure privacy.
3. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled.
4. Drinking-Water Facilities: Provide bottled-water, drinking-water units. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F.

B. Support Facilities: Comply with the following:

1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
3. Maintain support facilities until near Material Completion. Remove before Material Completion. Personnel remaining after Material Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

C. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

D. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.

E. Dewatering Facilities and Drains: Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent Work or temporary facilities.
2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar construction is completed.
3. Remove snow and ice as required to minimize accumulations.

F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste.

1. Provide separate containers, clearly labeled, for each type of waste material to be deposited.
2. Develop a waste management plan for Work performed on Project. Indicate types of waste materials Project will produce and estimate quantities of each type. Provide detailed information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.

G. Janitorial Services: Provide janitorial services on a daily basis for temporary offices, first-aid stations, toilets, wash facilities and similar areas.

H. Common-Use Field Office: Provide an insulated, weathertight, air-conditioned field office for use as a common facility by all personnel engaged in construction activities; of sufficient size to accommodate required office personnel and meetings at Project site. Keep office clean and orderly.

I. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site.

J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.

K. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.

L. Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest-control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Engage this pest-control service to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Material Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

3.3 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.

C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Material Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Material Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 01 Section "Closeout Procedures."

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 01 5100

TEMPORARY UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for temporary utilities, including but not limited to, the following:

1. Sewers and drainage.
2. Water service and distribution.
3. Heating and cooling facilities.
4. Ventilation.
5. Electric power service.
6. Lighting.
7. Telephone service.
8. Fire Protection.

1.2 USE CHARGES

A. General: Cost or use charges for temporary utilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary utilities without cost, including, but not limited to, the following:

1. Testing agencies.

B. Sewer Service: Pay sewer service use charges for sewer usage, by all parties engaged in construction, at Project site.

C. Water Service: Pay water service use charges, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site.

D. Electric Power Service: Pay electric power service use charges, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site.

1.3 SUBMITTALS

A. Temporary Utility Reports: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

B. Implementation and Termination Schedule: Within 15 days of date established for submittal of Construction Progress Schedule, submit a schedule indicating implementation and termination of each temporary utility.

1.4 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.

1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Regulations: Comply with industry standards and applicable laws and regulations, including but not limited to, the following:

1. Building Code requirements.
2. Health and safety regulations.
3. Utility company regulations.
4. Police, Fire Department and Rescue Squad rules.
5. Environmental protection regulations.
6. City ordinances and regulations.

1.5 PROJECT CONDITIONS

A. Permanent Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary facilities to use of permanent facilities.

1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: The following conditions apply to use of temporary utilities by all parties engaged in the Work:

1. Operate in a safe and efficient manner.
2. Take necessary fire prevention measures.
3. Do not overload system, or permit them to interfere with progress.
4. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.
5. Relocate temporary utilities as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

B. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

C. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.

D. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

E. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate temporary utilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify utilities as required.

B. Provide each utility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until utilities are no longer needed or are replaced by authorized use of completed permanent utilities.

C. Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

D. Storm Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
2. Connect temporary sewers to municipal system as directed by sewer department officials.

3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.

E. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use.

1. As soon as water is required at each level, extend service to form a temporary water- and fire-protection standpipe. Provide distribution piping. Space outlets so water can be reached with a 100-foot hose. Provide one hose at each outlet.
2. Provide pumps to supply a minimum of 30-psi static pressure at highest point. Equip pumps with surge and storage tanks and automatic controls to supply water uniformly at reasonable pressures.

F. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Maintain a minimum temperature of 50 deg F in permanently enclosed portions of building for normal construction activities, and 65 deg F for finishing activities and areas where finished Work has been installed.

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

H. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.

1. Install electric power service underground, unless overhead service must be used.
2. Install power distribution wiring overhead and rise vertically where least exposed to damage.
3. Connect temporary service to power source, as directed by electric company officials.

I. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.

1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
2. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or other traffic areas.
3. Provide metal conduit enclosures or boxes for wiring devices.

J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed.

K. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities. Install separate telephone line for each field office and first-aid station.

1. Provide additional telephone lines for the following:

   a. In field office with more than two occupants, install a telephone for each additional occupant or pair of occupants.
   b. Provide a dedicated telephone line for each facsimile machine and computer with modem in each field office.

2. Provide an answering machine with voice-mail service on superintendent's telephone.
3. Furnish superintendent with portable two-way radio for use when away from field office.
4. Provide a portable cellular telephone for superintendent's use in making and receiving telephone calls when away from field office.
5. Install a coin-operated telephone station at a convenient grade-level location for convenience of personnel.

L. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.

   a. Field Offices: Class A stored-pressure water-type extinguishers.
   b. Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
   c. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than two extinguishers on each floor at or near each usable stairwell.

2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
6. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
7. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.2 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary utilities. To minimize waste and abuse, limit availability of temporary utilities to essential and intended uses.

B. Maintenance: Maintain utilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.

1. Maintain operation of temporary heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Remove each temporary utility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Material Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary utility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the property of Contractor.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 01 5600

TEMPORARY BARRIERS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for temporary barriers and enclosures, including but not limited to, the following:

1. Environmental protection.
2. Tree and plant protection.
3. Site enclosure fence.
4. Security enclosure and lockup.
5. Barricades, warning signs, and lights.
6. Temporary enclosures.
7. Temporary partitions.

1.2 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to, the following:

1. Building Code requirements.
2. Health and safety regulations.
3. Utility company regulations.
4. Police, Fire Department and Rescue Squad rules.
5. Environmental protection regulations.
6. City ordinances and regulations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rail.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide each barrier and enclosure ready for use when needed to avoid delay. Maintain and modify as required by Work progress. Do not remove until barriers and enclosures are no longer needed or are replaced by authorized use of completed permanent facilities.

B. Environmental Protection: Provide protection and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.

D. Site Enclosure Fence: Before construction operations begin install chain-link enclosure fence with lockable entrance gates. Enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.

1. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

E. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

F. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
2. Vertical Openings: Close openings of 25 sq. ft. or less with plywood or similar materials.
3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.

3.2 OPERATION, TERMINATION, AND REMOVAL

A. Maintenance: Maintain facilities in good operating condition until removal.

B. Termination and Removal: Remove each temporary barrier and enclosure when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Material Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary barrier and enclosure. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials that constitute temporary barriers and enclosures are the property of Contractor.

2. At Material Completion, clean and renovate permanent barriers and enclosures used during construction period. Comply with final cleaning requirements in Division 01 Section "Closeout Procedures."

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirement for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Administrative procedures for handling requests for substitutions made after award of Contract are included in another Division 01 Section "Substitution Procedures".

1.2 PERFORMANCE REQUIREMENTS

A. Contractor shall comply with environmental laws controlling hazardous substances.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Products: Items that are demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, and equipment from those required by the Contract Documents and proposed by Contractor. Refer to Division 01 Section "Substitution Procedures".

C. Basis-of-Design Product Standard Specification: Where a specific manufacturer's product is named and accompanied by the words "Product Standard," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

E. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

F. Hazardous Substances Prohibited by Law: Including, but not limited to, any product, material, element, constituent, chemical, substance, compound, or mixture, which is defined in, included under, or regulated by any environmental laws.

G. Environmental Laws: Applicable local, state, and federal laws, rules, ordinances, codes, regulations, and requirements in effect at the time Contractor's services are rendered, any amendments for Contractor's services rendered after the effective date of any such amendments, including, without limitation, the following:

1. The Comprehensive Environmental Response, Compensation and Liability Act of 1980.
2. The Resource Conservation and Recovery Act.
3. The Toxic Substances Control Act.
4. The Clean Water Act.
5. The Clean Air Act.
6. The Marine Protection Research and Sanctuaries Act.
7. The Occupational Safety and Health Act.
8. The Superfund Amendments and Reauthorization Act of 1986.
9. The Environmental Protection Agency.
10. Other state superlien or environmental clean-up or disclosure statutes including all state and local counterparts of such.

1.4 SUBMITTALS

A. Contractor shall submit an affidavit on construction company letterhead signed by an officer of the company, notarized by a notary public, which certifies compliance with the environmental laws controlling hazardous substances for the construction of this Project.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products or materials for use on Project, product or material selected shall be compatible with products or materials previously selected, even if previously selected products or materials were also options.

B. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to the Architect.

1. Maintain one set of complete instructions at the job site during installation and until completion.

C. Compliance: Contractor shall take whatever measures deemed necessary to insure that all employees, suppliers, vendors, fabricators, subcontractors, or their assigns, to comply with hazardous substance requirements.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturers written instructions.

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.

2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products and materials to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
5. Store products to allow for inspection and measurement of quantity or counting of units.
6. Store products in a manner that will not endanger Project structure.
7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
8. Comply with product manufacturers written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
9. Protect stored products from damage.

1.7 PRODUCT AND MATERIAL WARRANTIES

A. General: Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

B. General Warranty: Special warranties specified in each Section shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

C. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Refer to Divisions 2 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

D. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTIONS

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.

5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Products and materials brought onto the Project Site, and products and materials incorporated into the Work, shall comply with environmental laws.

B. Descriptive Specification Requirements: Where Specifications describe a product, or assembly, listing exact characteristics required, without use of a brand or trade name, provide a product, material or assembly that provides the characteristics and otherwise complies with Contract requirements.

C. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product or material is specified for a specific application.

1. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.

D. Compliance with Standards, Codes and Regulations: Where Specifications only require compliance with imposed code, standard or regulation, select product that complies with standards, codes or regulations specified.

E. Visual Matching Specification: Where Specifications require matching an established sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.

1. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product.

F. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.

1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
2. Custom Range: Where Specifications include the phrase "custom range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.
3. Special Custom Range: Where Specifications include the phrase "special custom range of colors patterns, textures" or similar phrase, Architect will select a new color, pattern, or texture different from those normally produced by the manufacturer.

2.2 PRODUCT OPTIONS

A. For products proprietarily specified by a "Named Manufacturer" and model name or number, this is to establish standard of quality. Other manufacturers listed as "Acceptable Manufacturers" have been listed because they have implied compliance with requirements of the "Named Manufacturer". Listed "Acceptable Manufacturers" are not considered "Substitutions", and therefore, are not required to be submitted as such. However, costs, including professional service fees for changes or modifications to adjacent, contiguous, surrounding, supporting, or otherwise related areas, portions or parts of Project which are required to accommodate products and materials of "Acceptable Manufacturers", for complete, proper and functional installation, in lieu of specified "Named Manufacturer", shall be borne or paid by Contractor.

B. For products specified by naming several "Acceptable Manufacturers", select one of products, or manufacturers named, which complies with Contract Documents. Requests for manufacturer's products not listed must be submitted as Substitutions.

C. For products specified by naming only one product, or manufacturer, Contractor must submit request as for substitutions for product, or manufacturer not specifically named.

D. For products specified by naming only one product and manufacturer and indicated as "no substitute", there is no option.

E. For products specified only by reference standard, select product meeting that standard.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

A. Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

B. Inspect products immediately upon delivery and again prior to installation. Reject damaged and defective items.

C. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

D. Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

E. Recheck measurements and dimensions, before starting each installation.

F. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible product or material as necessary to prevent deterioration.

G. Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

H. Handle, install, connect, clean, condition and adjust products and materials in accord with manufacturer's instructions and in conformity with specified requirements.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with manufacturer for further instructions.
2. Do not proceed with work without clear instructions.

I. Perform work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

J. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Material Completion.

3.2 RESTRICTION OF HAZARDOUS SUBSTANCES

A. Contractor agrees that it shall not knowingly after reasonable diligence and effort, incorporate into the Work any hazardous substance other than as may be lawfully contained within products, except in accordance with applicable environmental laws. Further, in performing any of its obligations hereunder, Contractor shall not cause any release of hazardous substances into, or contamination of, the environment, including soil, the atmosphere, any watercourse or ground water, except in accordance with applicable environmental laws. In the event that Contractor engages in any of the activities prohibited in this paragraph, to the fullest extent permitted by law, Contractor hereby indemnifies and holds harmless Owner and its partners, members, officers, directors, agents, employees and consultants from and against any and all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorney's fees, arising out of, incidental to or resulting from the activities prohibited.

B. In the event Contractor observes on the Project Site any substance which Contractor reasonably believes to be a hazardous substance, and which is being introduced into the Work, or exists on the Project Site, in a manner violative of any applicable environmental laws, Contractor shall immediately notify Owner and report the condition to Owner in writing. The Work in the affected area shall not thereafter be resumed except by written authorization of Owner if in fact a hazardous substance has been encountered and has not been rendered harmless. In the event that Contractor fails to give Owner proper notification hereunder, upon knowingly observing a hazardous substance at the Project Site, to the fullest extent permitted by the law, Contractor hereby indemnifies and holds harmless Owner, and all of its partners, members, officers, directors, agents, employees and consultants from and against all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorneys' fees, arising out of, incidental to, or resulting from Contractor's failure to stop the Work.

C. If Owner believes that hazardous substances may have been located, generated, manufactured, used or disposed of on or about the Project Site by Contractor or any of its employees, agents, subcontractors, suppliers, or invitees, Owner may have environmental studies of the Project Site conducted as it deems appropriate, and Contractor shall be responsible for the cost of such studies to the extent that Contractor or any of its employees, agents, subcontractors, suppliers or invitees are responsible for the presence of any hazardous substances.

END OF SECTION

SECTION 01 7000

EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

1.2 SUBMITTALS

A. Qualification Data: For land surveyor or professional engineer to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.

C. Certified Surveys: Submit two copies signed and sealed by land surveyor or professional engineer.

D. Final Property Survey: Submit six copies showing the Work performed and record survey data.

E. Retention System Certification: Submit a statement certified by the Contractor's registered structural engineer that the design of components of the excavation support system is in compliance with provisions of the Contract Documents and the local building code, and is in keeping with generally accepted engineering practice.

1. Submit, if requested, design calculations, specifications and erection drawings, bearing the Contractor's registered structural engineer's stamp, to the local building code official.
2. Submit complete excavation support system shop drawings for information coordination purposes only.
3. Architect/Engineer will neither review nor approve excavation support system shop drawings.

1.3 QUALITY ASSURANCE

A. Land Surveyor Qualifications: Engage a professional land surveyor or engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Retention System Engineering: Each component of the excavation support system shall be designed by a registered structural engineer, in accordance with the local building code, and said engineer shall be employed by the Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility company that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than 72 hours in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.

C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Refer to Division 01 Section "Project Communications".

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.

2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

D. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Material Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Material Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights recommended by industry standards.
2. Allow for building movement, including thermal expansion and contraction.

G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction forces.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Material Completion.

G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Material Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Control."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Material Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 01 7329

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

1.2 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.3 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures for major cutting and patching at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how it will be performed, and indicate why it cannot be avoided.
2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
3. Products: List products to be used and firms or entities that will perform the Work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.4 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

C. Miscellaneous Elements: Do not cut and patch elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
5. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
    b. Patch fire rated assemblies with materials to match existing and maintain assembly fire rating.

4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION

SECTION 01 7419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging and/or recycling nonhazardous demolition and construction waste.
2. Disposing of nonhazardous construction waste.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

C. Salvage / Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

1.3 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

1.4 SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons (tonnes).
4. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).
5. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

C. Waste Reduction Calculations: Before request for Material Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

D. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

E. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Submittal: Letter signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements have been met.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.6 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements of this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
2. Disposed Materials: Indicate how and where materials will be disposed. Include name, address, and telephone number of each landfill and incinerator facility.
3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged / recycled materials.
5. Savings in hauling and tipping fees that are avoided.
6. Handling and transportation costs. Include cost of collection containers for each type of waste.
7. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.

B. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE

A. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

3.3 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION

SECTION 01 7700

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Project Record Documents.
3. Operation and maintenance manuals.
4. Warranties.
5. Instruction of Owner's personnel.
6. Final cleaning.

1.2 MATERIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Material Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs and photographic negatives, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mock-ups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Material Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Material Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.3 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Submit certified copy of Architect's Material Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

1.5 PROJECT RECORD DOCUMENTS

A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

B. Electronic File of Project Record Documents: Provide Architect with an independent electronic archive of accepted project record documents using electronic project management software as defined in Division 01 Section "Project Management and Coordination", in addition to the printed documents described below.

C. Record Drawings: Maintain and submit one set of reproducible Contract Drawings and one set of blue- or black-line white prints of Shop Drawings.

1. Mark Record Drawings to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

    a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
    b. Accurately record information in an understandable drawing technique.
    c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
    d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.

2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
3. Mark important additional information that was either shown schematically or omitted from original Drawings.
4. Note Change Order numbers, alternate numbers, and similar identification where applicable.
5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

D. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Note related Change Orders, Record Drawings, and Product Data, where applicable.

E. Record Product Data: Submit one copy of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Drawings, and Record Specifications, where applicable.

F. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:

1. Operation Data:

a. Emergency instructions and procedures.
b. System, subsystem, and equipment descriptions, including operating standards.
c. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
d. Description of controls and sequence of operations.
e. Piping diagrams.

2. Maintenance Data:

a. Manufacturer's information, including list of spare parts.
b. Name, address, and telephone number of Installer or supplier.
c. Maintenance procedures.
d. Maintenance and service schedules for preventive and routine maintenance.
e. Maintenance record forms.
f. Sources of spare parts and maintenance materials.
g. Copies of maintenance service agreements.
h. Copies of warranties and bonds.

B. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

1.7 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Material Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 DEMONSTRATION AND TRAINING

A. Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Provide instructors experienced in operation and maintenance procedures.
2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
3. Schedule training with Owner with at least seven days' advance notice.
4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.

B. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for the following:

1. System design and operational philosophy.
2. Review of documentation.
3. Operations.
4. Adjustments.
5. Troubleshooting.
6. Maintenance.
7. Repair.

3.2 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

C. Complete the following cleaning operations before requesting inspection for certification of Material Completion for entire Project or for a portion of Project:

1. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
4. Remove tools, construction equipment, machinery, and surplus material from Project site.

5. Remove snow and ice to provide safe access to building.
6. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances.
7. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
8. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
9. Sweep concrete floors broom clean in unoccupied spaces.
10. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
11. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials.
12. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
13. Remove labels that are not permanent.
14. Touch up and otherwise repair and restore marred, exposed finishes and surfaces.
15. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
16. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
17. Wipe surfaces of mechanical, electrical, elevator, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
18. Replace parts subject to unusual operating conditions.
19. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
20. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
21. Clean ducts, blowers, and coils if units were operated without filters during construction.
22. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
23. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
24. Leave Project clean and ready for occupancy.

D. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

E. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 01 8111

SUSTAINABLE CONSTRUCTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements and procedures for compliance with sustainable construction requirements.

1. Designed to Earn Energy Star: This Project is designed to achieve an EPA rating of 75 or higher. The designer has filed a Statement of Energy Design Intent, generated from Target Finder, with the U.S. Environmental Protection Agency.

a. The Contractor shall adhere to the design intent for products and systems indicated in the Contract Documents. Substitutions that may alter Energy Performance Goals will not be approved and no substitution shall be permitted without approval of the Design Team.

2. Submittal Forms and Supplemental Documents are attached at the end of this Section.

1.2 DEFINITIONS

A. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.

B. Project Materials Cost Data: Statement indicating total cost for building materials used for Project, excluding mechanical, electrical, and plumbing components, and specialty items such as elevators and equipment.

C. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

1. Mechanical, electrical and plumbing components and specialty items such as elevators and equipment shall not be included.

D. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.

1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.

2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

E. Inside Weatherproofing System: Materials and products that are installed on site within rooms, spaces, and portions of Project in which air is conditioned by Heating, Ventilation and Air Conditioning Systems.

1.3 SUBMITTALS

A. General: Sustainable construction submittals are in addition to other submittals.

B. Sustainable Construction Action Plans: Provide action plan within 30 days of date established for commencement of the Work indicating how the following requirements will be met:

1. Construction Waste Management: Waste management plan complying with Division 01 Section "Construction Waste Management and Disposal."
2. Recycled Content: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
3. Regional Materials: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
4. Certified Wood: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
5. Construction Indoor-Air-Quality Management Plan: Provide plan indicating how requirements will be met during construction.

C. Sustainable Construction Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with sustainable construction action plans for the following:

1. Construction Waste Management: Waste reduction progress reports complying with Division 01 Section "Construction Waste Management and Disposal."
2. Recycled content.
3. Regional materials.
4. Certified wood products.

D. Sustainable Construction Documentation Submittals:

1. Construction Waste Management: Comply with Division 01 Section "Construction Waste Management and Disposal."
2. Recycled Content: Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
3. Regional Materials: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
4. Certified Wood: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.

5. Indoor Air Quality During Construction:

   a. Construction indoor-air-quality management plan.
   b. Product data for temporary filtration media.
   c. Product data for filtration media used during occupancy.
   d. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.

6. Low Emitting Materials – Interior Adhesives and Sealants: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Low Emitting Materials – Interior Paints and Coatings: Product data for paints and coatings used inside the weatherproofing system indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. Low Emitting Materials; Carpet Systems:

   a. For carpet, documentation indicating compliance with testing and product requirements of CRI's "Green Label Plus" program.
   b. For installation adhesive, including printed statement of VOC content.

9. Laboratory Test Reports: For carpet and installation adhesives, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 2 - PRODUCTS

2.1 RECYCLED CONTENT OF MATERIALS

A. Recycled Content: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 10 percent of cost of materials used for Project.

   1. Cost of post-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
   2. Cost of post-consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
   3. Do not include mechanical and electrical components in the calculation.

2.2 REGIONAL MATERIALS

A. Regional Materials: Provide 10 percent of building materials (by cost) that are regional materials.

B. Regionally Extracted and Manufactured Materials: Provide 10 percent of building materials (by cost) that are regionally extracted and manufactured materials.

2.3 CERTIFIED WOOD (OPTIONAL)

A. Certified Wood: Provide a minimum of 50 percent (by cost) of wood-based materials that are produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

1. Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:

a. Rough carpentry.
b. Miscellaneous carpentry.
c. Finish carpentry.
d. Architectural woodwork.
e. Wood paneling.
f. Wood cabinets.

2.4 LOW-EMITTING MATERIALS

A. Adhesives and Sealants: For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Metal to Metal Adhesives: 30 g/L.
3. Adhesives for Porous Materials (Except Wood): 50 g/L.
4. Subfloor Adhesives: 50 g/L.
5. Plastic Foam Adhesives: 50 g/L.
6. Carpet Adhesives: 50 g/L.
7. Carpet Pad Adhesives: 50 g/L.
8. VCT and Asphalt Tile Adhesives: 50 g/L.
9. Cove Base Adhesives: 50 g/L.
10. Gypsum Board and Panel Adhesives: 50 g/L.
11. Rubber Floor Adhesives: 60 g/L.
12. Ceramic Tile Adhesives: 65 g/L.
13. Multipurpose Construction Adhesives: 70 g/L.
14. Fiberglass Adhesives: 80 g/L.
15. Contact Adhesive: 80 g/L.
16. Structural Glazing Adhesives: 100 g/L.
17. Wood Flooring Adhesive: 100 g/L.
18. Structural Wood Member Adhesive: 140 g/L.
19. Special Purpose Contact Adhesive (contact adhesive that is used to bond melamine covered board, metal, unsupported vinyl, Teflon, ultra-high molecular weight polyethylene, rubber or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
20. Top and Trim Adhesive: 250 g/L.
21. Plastic Cement Welding Compounds: 350 g/L.
22. ABS Welding Compounds: 400 g/L.
23. CPVC Welding Compounds: 490 g/L.
24. PVC Welding Compounds: 510 g/L.
25. Adhesive Primer for Plastic: 650 g/L.
26. Sheet Applied Rubber Lining Adhesive: 850 g/L.
27. Aerosol Adhesive, General Purpose Mist Spray: 65 percent by weight.
28. Aerosol Adhesive, General Purpose Web Spray: 55 percent by weight.
29. Special Purpose Aerosol Adhesive (All Types): 70 percent by weight.
30. Other Adhesives: 250 g/L.
31. Architectural Sealants: 250 g/L.

32. Nonmembrane Roof Sealants: 300 g/L.
33. Single-Ply Roof Membrane Sealants: 450 g/L.
34. Other Sealants: 420 g/L.
35. Sealant Primers for Nonporous Substrates: 250 g/L.
36. Sealant Primers for Porous Substrates: 775 g/L.
37. Modified Bituminous Sealant Primers: 500 g/L.
38. Other Sealant Primers: 750 g/L.

B. Interior Paints and Coatings: For field applications that are inside the weatherproofing system, use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions:

1. Flat Interior Topcoat Paints: VOC not more than 50 g/L.
2. Nonflat Interior Topcoat Paints: VOC not more than 150 g/L.
3. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
4. Clear Wood Finishes, Varnishes and Sanding Sealers: VOC not more than 350 g/L.
5. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
6. Floor Coatings: VOC not more than 100 g/L.
7. Shellacs, Clear: VOC not more than 730 g/L.
8. Shellacs, Pigmented: VOC not more than 550 g/L.
9. Stains: VOC not more than 250 g/L.
10. Primers, Sealers, and Undercoaters: VOC not more than 200 g/L.
11. Dry-Fog Coatings: VOC not more than 400 g/L.
12. Zinc-Rich Industrial Maintenance Primers: VOC not more than 340 g/L.
13. Pretreatment Wash Primers: VOC not more than 420 g/L.
14. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
15. Restricted Components: Paints and coatings shall not contain any of the following:

    a. Acrolein.
    b. Acrylonitrile.
    c. Antimony.
    d. Benzene.
    e. Butyl benzyl phthalate.
    f. Cadmium.
    g. Di (2-ethylhexyl) phthalate.
    h. Di-n-butyl phthalate.
    i. Di-n-octyl phthalate.
    j. 1,2-dichlorobenzene.
    k. Diethyl phthalate.
    l. Dimethyl phthalate.
    m. Ethylbenzene.
    n. Formaldehyde.
    o. Hexavalent chromium.
    p. Isophorone.
    q. Lead.
    r. Mercury.
    s. Methyl ethyl ketone.
    t. Methyl isobutyl ketone.
    u. Methylene chloride.
    v. Naphthalene.
    w. Toluene (methylbenzene).
    x. 1,1,1-trichloroethane.
    y. Vinyl chloride.

C. Carpet Systems:

1. Emissions: Provide carpet and cushion that complies with testing and product requirements of CRI's "Green Label" program.

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

A. Construction Waste Management: Comply with Division 01 Section "Construction Waste Management and Disposal."

3.2 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

A. Indoor Air Quality During Construction: Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."

1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 01 Section "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
2. Replace all air filters immediately prior to occupancy.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

Material / Product Name	Manufacturer / Vendor	Total Material / Product Cost ($)	Percentage Complaint (%)	Recycled Content: Post-Consumer (% by Weight)	Recycled Content: Pre-Consumer (% by Weight)	Recycled Content: Recycled Content Information Source	Regional Materials: Harvest Distance (mi)	Regional Materials: Manufact. Distance (mi)	Regional Materials: Harvest / Manufact. Location Info Source	FSC Certified Wood (Optional): Wood Component Percentage %	FSC Certified Wood (%)	FSC Chain-of-Custody Certificate Number

combined

Recycled

locally

Local

Total value of Wood:

Total value of FSC Wood:

FSC Certified

*This form is available in electronic format per your request.

SECTION 02 4119

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes selective removal and subsequent offsite disposal of portions of existing building indicated on drawings and as required to accommodate new construction.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner's designated storage area.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.4 SUBMITTALS

A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Locations of temporary partitions and means of egress.

D. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

E. Predemolition Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.

1.5 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Professional Engineer Qualifications: Comply with Division 01 Section "Quality Assurance."

C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction. Comply with applicable regulations, codes and ordinances.

D. Standards: Comply with ANSI A10.6 and NFPA 241.

E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

1.6 PROJECT CONDITIONS

A. Owner assumes no responsibility for condition of areas to be selectively demolished. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.

B. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

C. Storage or sale of removed items or materials on-site will not be permitted.

D. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

A. Use repair materials identical to existing materials.

1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
2. Use materials whose installed performance equals or surpasses that of existing materials.

B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.

B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.

1. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.

C. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.

1. Arrange with Owner to shut off indicated utilities.
2. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
3. Protect existing site improvements, appurtenances, and landscaping to remain.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furnishings, and equipment that have not been removed.

C. Temporary Enclosures: Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

D. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

E. Temporary Shoring: Provide and maintain shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished. Strengthen or add new supports when required during progress of selective demolition.

3.4 POLLUTION CONTROLS

A. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.

B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.5 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.
3. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
4. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
5. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, verify condition and contents before starting flame-cutting operations.
6. Maintain portable fire-suppression devices during flame-cutting operations.
7. Maintain adequate ventilation when using cutting torches.
8. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
9. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
10. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
11. Dispose of demolished items and materials promptly.
12. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

B. Existing Facilities: Comply with building manager's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.

C. Removed and Salvaged Items: Comply with the following:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items: Comply with the following:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.6 PATCHING AND REPAIRS

A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.

B. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

1. Completely fill holes and depressions in existing concrete or masonry that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 03 1000

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division - 01 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. The work of this section includes all labor, materials and equipment required to form all cast-in-place concrete shown on the drawings including but not limited to all slabs, joists, beams, columns, walls, stairs, and equipment pads.

1.3 CODES AND STANDARDS

A. Comply with the provision of the following codes, specifications and standards except where more stringent requirements are shown or specified:

1. ACI 301 "Specifications for Structural Concrete for Buildings"

2. ACI 318 "Building Code Requirements for Reinforced Concrete"

3. ACI 117 "Specifications for Tolerances for Concrete Construction and Materials".

4. Concrete Reinforcing Steel Institute " Manual of Standard Practice"

1.4 RESPONSIBILITY

A. The design, construction and safety of all formwork shall be the responsibility of the General Contractor. All forms, shores, backshores, falsework, bracing, and other temporary supports shall be engineered to support all loads imposed including the wet weight of concrete, construction equipment, live loads, lateral loads due to wind and wet concrete imbalance. The Contractor shall also be responsible for determining when temporary supports, shores, backshores, and other bracing may be safely removed.

1.5 ENVIRONMENTAL OBJECTIVES

A. The Owner has established environmental goals and strategies for achieving them for this project based upon the LEED® Green Building Rating System for New Construction & Major Renovations Version 2.2 dated October 2005, as developed by the U.S. Green Building Council. Refer to Division 1 Section "Sustainable Design Requirements."

B. Manufacturer to supply documentation to verify compliance with the following requirements before consideration as an "acceptable manufacturer:"

1. The following are mandatory requirements for the overall project:

a. The material(s) in the product(s) supplied should have a recycled content such that the sum of the post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 20% of the total value of the material in the project.
b. 20% of the product(s) supplied is extracted, processed, and manufactured regionally within a radius of 500 miles of this Project.
c. Paints and coatings must meet or exceed the VOC and chemical component limits of Green Seal requirements.
d. The VOC content of adhesives and sealants must be less than the current VOC content limits of South Coast Air Quality Management District (SCAQMD) Rule #113, Architectural Coatings, rules in effect on January 1, 2004.

C. Products that conform to requirements of the Environmental Objectives yet do not fully meet other requirements of this Section may still be considered for use at the sole discretion of the Design Professional.

1.6 DESIGN RESPONSIBILITY

A. The design of all concrete formwork, formwork removal, shoring, and backshoring requirements shall be performed by a registered professional engineer in the state where the project is located and experienced in the design of concrete formwork. The Contractor shall employ the formwork engineer. Calculations, sealed by the registered professional engineer, shall be issued for Design Professional's record but will not be reviewed or returned.

1.7 SUBMITTALS

A. LEED Submittals

1. Recycled Content- Credit MR4.1/MR 4.2: Provide documentation indicating percentages of post-consumer and pre-consumer recycled content by weight per unit of product or assembly containing the product. Indicate the percentage of the dollar value of the recycled content compared to the total dollar value of the product or assembly containing the product.

2. Material Proximity- Credit MR 5.1/MR 5.2: Where the distances to the project site is 500 miles or less, indicate location and distance to project site of extraction, harvesting, recovery and manufacturing of all materials. Indicate the dollar value of the material cost of the product containing local/regional materials. Where product components are sourced or manufactured in separate locations, provide location and percentage by weight of each component per unit of product.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Rough-formed finished concrete: Unless otherwise specified, the default finish for formed surfaces shall be rough-form finish constructed with plywood, lumber, metal or other acceptable material. Lumber shall be dressed on at least two edges and one side for tight fit. The minimum grade shall be B-C, exterior grade.

2.2 FORMWORK COATINGS

A. Formwork coatings shall be a commercial formulation that will not bond with, stain, nor adversely affect concrete surfaces or impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede curing with water or curing compounds. Provide a product that has a maximum VOC (Volatile Organic Compounds) of 50 g/l but not greater than

that permitted by the local government agency having jurisdiction in the area where the project is located.

Products: provide one of the following:

"Enviroform", Conspec Marketing and Manufacturing Co., Inc.
"Cast-Off WB", Sonneborn Building Products
"Farm Fresh", Unitex
"Formshield WB"; Tamms Industries
"Form-Eze Natural", The Euclid Chemical Company, Inc.
"Bio-Form", Universal Form Clamp
"Aqua Blue", US Spec

2.3 NAILS AND FASTENERS

A. Use only galvanized nails and fasteners for securing formwork in structures exposed to weather or unconditioned spaces such as garages, canopies and porte-cocheres.

2.4 FORM TIES

A. Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to minimize spalling of concrete on removal.

2.5 CHAMFER STRIPS

A. Provide wood, metal, PVC, or rubber strips, ¾ by ¾ inch, minimum.

PART 3 - EXECUTION

3.1 FABRICATION AND CONSTRUCTION

A. Design, erect, support, brace and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic construction loads that might be applied until the concrete structure can support such loads.

B. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

D. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace

temporary openings and patch forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

F. Chamfer exposed corners and edges as indicated, using specified chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

3.2 CLEANING AND TIGHTENING

A. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and all other debris just prior to concrete placement. Retighten forms and bracing prior to concrete placement as required to prevent mortar leaks and maintain proper alignment.

3.3 CLEANING AND RE-USE OF FORMS

A. Forms reused in the work shall be repaired and cleaned. Split, frayed, delaminated, or otherwise damaged facing material will not be acceptable for exposed surfaces. Forms intended for successive concrete placement shall have surfaces cleaned, fins and laitance removed, and joints tightened to avoid surface offsets. New form coating compound shall be applied to reused forms. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.4 TOLERANCES

A. Unless specified otherwise, all tolerances for concrete formwork shall conform to ACI Standard 117, "Standard Tolerances for Concrete Construction and Materials". Before concrete placement the Contractor shall check lines and levels of erected formwork and make any corrections and adjustments as required to ensure proper size and location of concrete members and stability of forming systems. During concrete placement the Contractor shall check formwork and supports to ensure that forms have not displaced and that completed work will be within specified tolerances.

B. Construct forms so as to limit the offset between adjacent pieces of formwork facing material in accordance with the following classifications as defined in ACI 117. The offset limits shall apply to both abrupt and gradual variations in the surface.

3.5 SHORES AND SUPPORTS

A. Definitions

1. Shores: Vertical or inclined support members designed to carry the weight of formwork, concrete, and construction loads above.

3.6 REMOVAL OF FORMS AND SUPPORTS

A. Records of Weather Conditions: The General Contractor shall be responsible for keeping records of weather conditions to be used in the decision on when to remove forms.

B. Formwork Not Supporting Concrete: Formwork not supporting concrete such as sides of beams, walls, columns and similar parts of the structure, may be removed after cumulatively (not necessarily consecutively) curing at not less than 50°F for 12 hours after placing concrete, provided the concrete is sufficiently hard so as not to be damaged by form removal operations and provided curing and protection operations are maintained. If ambient air temperatures remain below 50°F, if retarding agents are used, or if Type II and Type V portland cement is used, then this specified minimum period should be increased as required to safely remove the forms without damage to the concrete. Where such forms also support formwork for slab or beam soffits, the removal times of the latter shall govern.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 03 2000

CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections apply to work of this section.

1.2 DESCRIPTION OF WORK

The work of this section includes labor, materials, hardware, equipment, transportation and services required to fabricate and place all reinforcement for cast-in-place concrete including bars, welded wire fabric, ties and supports shown on the drawings and as specified.

1.3 ENVIRONMENTAL OBJECTIVES

A. The Owner has established environmental goals and strategies for achieving them for this project based upon the LEED® Green Building Rating System for New Construction & Major Renovations Version 2.2 dated October 2005, as developed by the U.S. Green Building Council. Refer to Division 1 Section "Sustainable Design Requirements."

B. Manufacturer to supply documentation of compliance with the following requirements before consideration as an "acceptable manufacturer:"

1. The following are mandatory requirements for the overall project:

a. The material(s) in the product(s) supplied shall have a recycled content such that the sum of the post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 20% of the total value of the material in the project.
b. 20% of the product(s) supplied is extracted, processed, and manufactured regionally within a radius of 500 miles of this project.

1.4 QUALITY CONTROL

A. The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

B. Codes and Standards: Comply with all provisions of the following codes, specifications and standards except where more stringent requirements are shown or specified:

1. ACI 301 - "Specifications for Structural Concrete for Buildings".

2. ACI 117 - 'Specifications for Tolerances for Concrete Construction and Materials."

3. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".

4. ANSI/AWS D1.4 "Structural Welding Code – Reinforcing Steel"

1.5 SUBMITTALS

A. Shop Drawings: Submit shop drawings for all reinforcing steel and related accessories for the Design Professional's approval. Shop drawings shall show arrangement and layout, bending and assembly diagrams, bar schedules, stirrup spacing, splicing and laps of bars and shall be prepared in accordance with CRSI Standards.

B. Mill Certificates: Submit, for record, mill certificates and/or test results signed by Contractor and Producer, for all reinforcement.

C. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including mechanical splices, hooked anchorage systems, large-headed stud punching shear reinforcement, dowel bar substitute systems, and dowel bar sleeves.

D. International Code Council (ICC) Evaluation Service Reports: Submit evaluation service reports of approval from ICC Evaluation Service, Inc. for mechanical splice, hooked anchorage systems, large-headed stud punching shear reinforcement and dowel bar substitute systems.

E. LEED Submittals

1. Recycled Content- Credit MR4.1/MR 4.2: Provide documentation indicating percentages of post-consumer and pre-consumer recycled content by weight per unit of product or assembly containing the product. Indicate the percentage of the dollar value of the recycled content compared to the total dollar value of the product or assembly containing the product.

2. Material Proximity- Credit MR 5.1/MR 5.2: Where the distance to the project site is 500 miles or less, indicate location and distance to project site of extraction, harvesting, recovery and manufacturing of all materials. Indicate the dollar value of the material cost of the product containing local/regional materials. Where product components are sourced or manufactured in separate locations, provide location and percentage by weight of each component per unit of product.

1.6 PREINSTALLATION CONFERENCE

A. The Reinforcing-Placing subcontractor shall attend the Pre-Concrete Conference conducted by the Concrete Contractor as described in Specification Section "Cast-in-Place Concrete".

1.7 TESTING AND INSPECTION

A. Perform all tests and inspections of reinforcing steel as specified herein.

B. Any testing laboratory retained to run tests required by this specification shall meet the basic requirements of ASTM E 329.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcement:

1. Reinforcing materials shall be delivered from the mill in bundles that are identified as to heat number and manufacturer and accompanied with mill and analysis test reports and

an affidavit from the supplier stating that the material conforms to the requirements of the governing ASTM specification listed herein.

2. Deformed bar material that is not identifiable according to the criteria listed above shall be tested for tensile strength and bend tests according to ASTM A 615 on a sample of 2 bars for each ten tons or fraction thereof of unidentified material for each bar size. The bars shall be a minimum of 24 inches long. Bend tests are not required for #14 and # 18 bars. Submit the results of such tests for record.

3. Reinforcing Bars: Reinforcing bars shall conform to ASTM A 615 Grade 60 as noted on the drawings.

4. Weldable Reinforcing Bars: All reinforcing bars noted on the drawings as being required to be welded shall conform to ASTM A 706.

5. Use Reinforcing steel made from 100% recycled material, 2/3 of which shall be post-consumer material. A minimum of 20% of the material in the reinforcement must have been extracted, harvested, or recovered as well as manufactured, within 500 miles of the project site.

6. Plain Steel Welded Wire Reinforcement: ASTM A 185 with a yield strength of 65,000 PSI. Provide in flat sheets only.

7. Tie Wire: Tie wire shall be annealed steel tie wire, minimum 16 gauge.

8. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations.

    a. Slabs-on-Grade: Use precast concrete bar supports (dobies) or supports with sand plates or horizontal runners designed for use on ground.
    b. Spread Footing Bottom Reinforcement: Use precast concrete bar supports (dobies) or chairs designed for soil-supported slabs.

PART 3 - EXECUTION

3.1 FABRICATION AND DELIVERY

A. Bending and Forming: Fabricate bars of indicated sizes and accurately form to shapes and lengths indicated and required, by methods not injurious to materials. Do <u>not</u> heat reinforcement for bending. Bars shall be free from injurious defects, have a workman-like finish with no excessive rust and/or pitting and have no unusual kinks or bends.

B. Marking and Shipping: Bundle reinforcement and tag in accordance with Section 7.4.5 of the CRSI "Manual of Standard Practice". Transport and store at site so as not to damage material. Keep sufficient supply of tested, approved and proper reinforcement at the site to avoid delays. Maintain reinforcing bars free of mud, dirt, grease, or other coating.

3.2 PLACING REINFORCEMENT

A. Comply with CRSI recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports and as herein specified.

B. Before placing reinforcement and again before concrete is placed, clean reinforcement of loose rust and mill scale, earth, ice and other materials which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by chairs, runners, bolsters, spacers and hangers, as required. Exercise particular care to maintain proper distance and clearance between parallel bars and between bars and forms. Provide spreaders and spacers to hold steel in position. Support steel at proper height upon approved chairs.

D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set tie wires so ends are directed into concrete, not toward exposed concrete surfaces.

E. Support of Spread Footing Reinforcing Steel

1. Bottom Steel: Support bottom reinforcing mat to provide the specified clearance to the bars. Spacing between supports shall not exceed 4'-0" centers each way.

2. Top Steel: Support top reinforcing on steel angle frames braced in both directions or on special standee support bars. Spacing between supports shall not exceed 4'-0" centers each way. The depth of the supports shall provide the specified clearance from the bars to the top of the concrete. The design of the support steel shall be the responsibility of the Contractor.

F. Install welded wire reinforcement in as long lengths as practicable. Lap adjoining pieces at least one full mesh plus two inches and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

G. Coordinate with other trades and expedite materials and labor to avoid omissions and delay.

H. Extend reinforcement continuous through construction joints unless otherwise shown on the drawings.

I. Provide and place additional reinforcing steel at all sleeves and openings in beams, slabs and walls as specified on the drawings. Where sleeves or openings not shown on the drawings interrupt the reinforcement, consult with Design Professional for instructions for placing and splicing of bars. Provide required additional reinforcing steel at no additional cost to the Owner.

3.3 SPLICING REINFORCING STEEL

A. Provide splice as indicated on the drawings. Splice reinforcing bars only at locations shown on the structural drawings and approved shop drawings. Unauthorized or unscheduled splices not approved by the Design Professional in writing will not be accepted.

B. All lap splices in reinforcing steel shall be contact lap splices unless detailed otherwise on the drawings.

C. Maintain proper cover between reinforcing bars at splices.

D. Lap unscheduled reinforcing bars not otherwise specified a minimum of 30 bar diameters at splices. Lap welded wire fabric a minimum of one full wire mesh plus two inches.

E. Manufacturer of mechanical tension splice shall be present for first day's installation.

3.4 WELDING REINFORCING STEEL

A. Welding reinforcing steel is permitted only where specifically shown on the drawings. All welding shall conform to AWS D1.4. Only weldable reinforcing steel conforming to ASTM A 706 or deformed bar anchors conforming to ASTM A 496 shall be permitted. ASTM A 615 bars may not be welded for structural use.

3.5 SHRINKAGE AND TEMPERATURE REINFORCEMENT

A. Provide shrinkage and temperature reinforcement as indicated on the drawings at right angles to main top and bottom bars for all structural slabs unless detailed otherwise on the drawings.

3.6 PLACEMENT OF WELDED WIRE REINFORCEMENT

A. Wherever welded wire reinforcement is specified as reinforcement in pan-formed beams or slabs, it shall be continuous and properly lapped one full wire spacing plus 2" across the entire concrete surface and not interrupted by beam or girders.

3.7 REINFORCEMENT IN COMPOSITE METAL DECK SLAB

A. Composite metal deck slabs shall be reinforced as indicated on the drawings.

B. Extra Reinforcement Over Girders: Provide additional reinforcing steel over interior girders as shown on the drawings.

C. Placement of Slab Reinforcement: Provide bolsters, high chairs, and/or additional reinforcing as shown in details on the drawings to support the reinforcing with the clear cover shown on the drawings.

3.8 REINFORCEMENT AROUND OPENINGS IN COMPOSITE METAL DECK SLABS

A. For all openings in metal deck not framed with structural steel and greater than 10" in width in either direction, provide additional reinforcing steel as shown in details on the drawings.

3.9 REINFORCEMENT IN TOPPING SLABS

A. Provide welded smooth wire reinforcement minimum 6 x 6 W1.4 x W1.4 in all topping slabs unless specified otherwise on the drawings.

3.10 REINFORCEMENT IN HOUSEKEEPING PADS

A. Provide welded smooth wire reinforcement 6 x 6 W2.9 x W2.9 minimum in all housekeeping pads supporting mechanical equipment unless detailed otherwise on the drawings.

3.11 MECHANICAL AND PLUMBING REQUIREMENTS

A. Refer to Mechanical and Plumbing Drawings for concrete requiring reinforcing steel. Such reinforcement shall be furnished as part of the work of this section.

3.12 QUALITY ASSURANCE TESTING AND INSPECTION DURING CONSTRUCTION

A. See Testing Laboratory Services section of these Specifications for reinforcing inspection and testing requirements.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of concrete work is shown on drawings, including schedules, notes and details which show size and location of members and type of concrete to be poured. Furnish all labor, materials, services, equipment and hardware required in conjunction with or related to the forming, delivery and pouring of all poured-in-place concrete work.

B. Concrete paving and walks are specified in Division 32.

C. Concrete Formwork, Reinforcement are specified in other Division-03 sections.

1.3 ENVIRONMENTAL OBJECTIVES

A. The Owner has established environmental goals and strategies for achieving them for this project based upon the LEED® Green Building Rating System for New Construction & Major Renovations Version 2.2 dated October 2005, as developed by the U.S. Green Building Council. Refer to Division 101 Section "Sustainable Design Requirements."

B. Manufacturer to supply documentation of compliance with the following requirements before consideration as an "acceptable manufacturer:"

1. The following are mandatory requirements for the overall project:

a. The material(s) in the product(s) supplied should have a recycled content such that the sum of the post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 20% of the total value of the material in the project.
b. 20% of the product(s) supplied is extracted, processed, and manufactured regionally within a radius of 500 miles of this Project.
c. Paints and coatings must meet or exceed the VOC and chemical component limits of Green Seal requirements.
d. The VOC content of adhesives and sealants must be less than the current VOC content limits of South Coast Air Quality Management District (SCAQMD) Rule #113, Architectural Coatings, rules in effect on January 1, 2004.

1.4 QUALIFICATIONS

A. The concrete supplier shall have a minimum of five years experience in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment. The supplier must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

B. The concrete contractor shall have a minimum of five years experience with installation of concrete similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful –service performance.

C. Any testing laboratory retained to run tests required by this specification shall meet the basic requirements of ASTM E 329.

1.5 QUALITY CONTROL

A. The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

B. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:

1. ACI 301 – "Specifications for Structural Concrete for Buildings".

2. ACI 117 – 'Specifications for Tolerances for Concrete Construction and Materials."

3. ACI 318 – "Building Code Requirements for Reinforced Concrete".

4. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".

C. Document Conflict and Precedence: In case of conflict among documents, including architectural and structural drawings and specifications, notify the Design Professional prior to submitting proposal. In case of conflict between and/or among the structural drawings and specifications, the strictest interpretation shall govern, unless specified otherwise in writing by the Design Professional.

D. Inspection and Testing of the Work: Materials and installed work may require testing and retesting, as directed by the governing building code or the Design Professional, at any time during progress of work. The Contractor shall provide adequate notification to the Design Professional's Testing Agency of construction operations including the project schedule to allow the Testing Agency to schedule inspections. The Contractor shall make adequate arrangement with the Design Professional's Testing Agency for inspection of material stockpiles and facilities. Inspection or testing by the Design Professional's Testing Agency does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents. Tests not specifically indicated to be done at the Testing Agency's expense, including retesting of rejected materials and installed work, shall be done at the Contractor's expense. See Testing Laboratory section of the Specifications.

E. Acceptance Criteria for Concrete Strength: The strength level of an individual class of concrete shall be considered satisfactory if it meets or exceeds the specified f'c.

1. A strength test is defined as the average strength of two 6" x 12" cylinder breaks or three 4" x 8" cylinder breaks tested at the strength age indicated on the drawings for that class of concrete.

F. Responsibility for Selection and Use of Concrete Admixtures and Chemical Treatments: The Contractor shall be responsible for selecting admixtures and surface treatments that are compatible with the intended use of the concrete including all final surface treatments called for within this or other specifications or on the structural or architectural drawings. The Contractor is responsible for following the manufacturer's instructions for the use of their product including abiding by any limitations placed by the manufacturer on the use of any of its products.

G. Survey for Anchor Rods and Reinforcing Steel Dowels: The Contractor shall use a qualified, surveyor to lay out the proper location of all embedded anchor rods and reinforcing steel dowels for columns above before they are encased in concrete. The surveyed locations of such elements shall be submitted to the Design Professional for record.

1.6 PREINSTALLATION CONFERENCES

A. Pre-Concrete Conference:

1. At least 7 days prior to beginning concrete work, the Contractor shall conduct a meeting to review the proposed mix designs and to discuss required methods and procedures to produce concrete construction of the required quality. Also review requirements for submittals, status of coordinating work and availability of materials. Establish work progress schedule and procedures for materials inspection, testing and certifications. The contractor shall send a pre-concrete conference agenda to all attendees 7 days prior to the scheduled date of the conference.

2. The Contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:

Contractor's Superintendent
Laboratory responsible for the concrete design mix
Laboratory responsible for field quality control
Concrete Subcontractor
Ready-Mix Concrete Producer
Owner's and Design Professional's Representative

3. Minutes of the meeting shall be recorded, typed and printed by the Contractor and distributed by him to all parties concerned within 5 days of the meeting. One copy of the minutes shall be transmitted to the following for information purposes:

Owner's Representative
Design Professional

4. The Design Professional shall be present at the conference. The Contractor shall notify the Design Professional at least 7 days prior to the scheduled date of the conference.

1.7 SUBMITTALS

A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including admixtures, patching compounds, epoxies, grouts, waterstops, joint systems, fiber reinforcement, curing compounds, dry-shake finish materials, hardeners, sealers mechanical splices, hooked anchorage systems, dowel bar substitute systems, dowel bar sleeves, and others as requested by Design Professional.

B. Samples: Submit samples of materials specified if requested by Design Professional, including names, sources and descriptions.

C. Mix Designs: Submit mix designs as specified herein.

D. Material and Mill Certificates: Provide material and mill certificates as specified herein and in the Testing Laboratory section of the Specifications. The Manufacturer and Contractor shall sign the material and mill certificates certifying that each material item complies with specified

requirements. Provide certification from admixture manufacturers that chloride ion content complies with specified requirements.

E. Construction Joints: Submit drawing of proposed construction joint locations in concrete for slab on grade, mat foundations, structural floors, roofs and walls. Submit any additional or changed reinforcing that is required at construction joints that differs from that shown on the drawings.

F. Minutes of preconstruction conference.

G. Surveys: Submit report certifying that all anchor rods and reinforcing dowels into columns above are in their proper location prior to placing of concrete.

H. LEED Submittals

1. Recycled Content- Credit MR4.1/MR 4.2: Provide documentation indicating percentages of post-consumer and pre-consumer recycled content by weight per unit of product or assembly containing the product. Indicate the percentage of the dollar value of the recycled content compared to the total dollar value of the product or assembly containing the product.

2. Material Proximity- Credit MR 5.1/MR 5.2: Where the distance to the project site is 500 miles or less, indicate location and distance to project site of extraction, harvesting, recovery and manufacturing of all materials. Indicate the dollar value of the material cost of the product containing local/regional materials. Where product components are sourced or manufactured in separate locations, provide location and percentage by weight of each component per unit of product.

1.8 PROVISION FOR OTHER WORK

A. Provide for installation of inserts, hangers, metal ties, anchors, bolts, angle guards, dowels, thimbles, slots, nailing strips, blocking, grounds and other fastening devices required for attachment of work. Properly locate in cooperation with other trades and secure in position before concrete is poured. Do not install sleeves in any concrete slabs, beams or columns except where shown on the drawings or upon written approval of the Design Professional.

B. Protect adjacent finish materials against damage and spatter during concrete placement.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

Refer to the drawings for classes and strengths of concrete required.

1. Portland Cement: ASTM C 150, Type I or Type III, or ASTM C 1157, Type GU or HE unless otherwise approved by the Design Professional. Use one brand of cement, for each class of concrete, throughout the project, unless approved otherwise by the Design Professional. Submit mill certificates certifying conformance to this specification for each brand and type of cement.

2. Testing of cement in lieu of mill certificate submittal will be required if:

a. The cement has been in storage at the mixing site for over 30 days

b. It is suspected by the Owner, Design Professional or Design Professional's Testing Laboratory that the cement has been damaged in storage or in transit or is in any way defective.

B. Fly Ash: ASTM C 618, Class C or F.

C. Slag Cement: ASTM C 989, Grade 100 or 120 or ASTM C 595, Type IS or Type S.

D. Normal weight Aggregates: ASTM C 33, Class 4M, and as herein specified. Submit material certificates from aggregate supplier or test results from an independent testing agency certifying conformance to this specification for each source of aggregate.

E. Water: Comply with the requirements of ASTM C 1602

F. Cementitious materials, aggregate, and water must be extracted or recovered as well as manufactured within 500 miles of the project site.

G. Air-Entraining Admixture: ASTM C 260. Provide air entrainment as specified in Table 4.2.2.4.of ACI 301-05 in all concrete exposed to freezing and thawing. Interior steel troweled surfaces subjected to vehicular traffic shall not have more than 3% entrained air. Surfaces scheduled to receive hardeners shall not have more than 3% entrained air.

Provide one of the following products and manufacturers:

"Darex" or "Daravair" series; W. R. Grace & Co.
"MBAE90" or "Micro-Air"; BASF Admixtures, Inc
"Sika AER"; Sika Corporation
"Air Mix" or "AEA-92"; The Euclid Chemical Company, Inc.
"Eucon Air 30" or "Eucon Air 40", The Euclid Chemical Co., Inc.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

H. Water-Reducing Admixture: ASTM C 494, Type A. See maximum permissible chloride ion content in concrete specified below.

Provide one of the following products and manufacturers:

"Pozzolith 322N" or "Polyheed 997"; BASF Admixtures, Inc.
"Plastocrete 161"; Sika Chemical Corp.
"Eucon WR-75 or WR-91"; The Euclid Chemical Company, Inc.
"WRDA ";series W.R. Grace & Co.
"Eucon NW" or "Eucon LW", The Euclid Chemical Company, Inc.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

I. Mid-Range Water-Reducing Admixture: ASTM C 494, Type A and Type F. See maximum permissible chloride ion content in concrete specified below.

Provide one of the following products and manufacturers:

"Polyheed 997", BASF Admixtures, Inc.
"Eucon MR", The Euclid Chemical Company, Inc.
"Sikament HP", Sika Chemical Corp.

"Daracem" or "Mira " series, W.R. Grace & Co.
"Eucon X15" or "Eucon X20", The Euclid Chemical Company, Inc.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

J. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or Type G. See maximum permissible chloride ion content in concrete specified below.

Provide one of the following products and manufacturers:

"ADVA" or "Daracem" Series; W.R. Grace & Co.
"Rheobuild 1000" or "Glenium 30/30"; BASF Admixtures, Inc.
"Sikament"; Sika Chemical Corp.
"Eucon 37/1037" or "Plastol" series; The Euclid Chemical Company, Inc.
"Euconl SP" or "Eucon RD", The Euclid Chemical Company, Inc.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

K. Water-Reducing, Accelerator Admixture (Non-Corrosive, Non-Chloride): ASTM C 494, Type C or E. See maximum permissible chloride ion content in concrete specified below.

Provide one of the following products and manufacturers:

"Polarset";"Gilco", "Lubricon NCA" or "DCI", W.R. Grace & Co.
"Pozzutec 20+"; BASF Admixtures, Inc.
"Accelguard 80/90"; "NCA", or "AcN", The Euclid Chemical Company, Inc.
"Plastocrete 161FL", Sika Chemical Co.
"Eucon AcN", The Euclid Chemical Company, Inc.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

L. Water-Reducing, Retarding Admixture: ASTM C 494, Type D. See maximum permissible chloride ion content in concrete specified below.

Provide one of the following products and manufacturers:

"Daratard" series, W.R. Grace & Co.
"Pozzolith 100XR" or "Pozzolith 300R; BASF Admixtures, Inc.
"Plastiment"; Sika Chemical Co.
"Eucon Retarder", Series, The Euclid Chemical Company, Inc.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

M. Calcium Chloride and Chloride Ion Content:

1. Calcium chloride or admixtures containing more than 0.5% chloride ions by weight of the admixture are not permitted.

2. The maximum water soluble chloride ion concentration in hardened concrete at ages from 28 to 42 days contributed from all ingredients including water,

aggregates, cementitious materials, and admixtures shall not exceed the limits specified in ACI 301-05 Table 4.2.2.6. Water-soluble chloride ion tests shall conform to ASTM C 1218. One test shall be run for each class of concrete before the mix design submittal and each time a change is made to the mix design (such as change in aggregate type or source).

3. The Concrete Supplier shall certify on the Mix Design Submittal Form that the chloride ion content in all concrete mix designs used on the project does not exceed the limits stated above.

N. Certification: Written conformance to all the above mentioned requirements and the chloride ion content of the admixture as tested by an accredited laboratory will be required from the admixture manufacturer at the time of mix design review by the Design Professional.

2.2 RELATED MATERIALS

a. Waterstops: Provide waterstops at all construction joints and other joints in all foundation walls below grade and where shown on the drawings. Size to suit joints. Provide Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, ¾ inch.

1. Carlisle Coatings & Waterproofing, Inc.; MiraSTOP .
2. CETCO; Volclay Waterstop-RX
3. Concrete Sealants Inc.; Conseal CS-231
4. Greenstreak; Swellstop.
5. Henry Company, Sealants Division; Hydro-Flex
6. JP Specialties, Inc.; Earth Shield Type 20

B. Vapor Barrier: See specification 07 2617 for underslab vapor barrier and tape.

C. Epoxy Products: Two component material suitable for use on dry or damp surface, complying with ASTM C 881.

1. Products for Crack Repair:

"Sikadur 35 Hi Mod LV"; Sika Chemical Company – injection type
"Sikadur 52", Sika Chemical Company – injection type
"Sikadur 55 SLV", Sika Chemical Company – gravity feed
"Eucopoxy Injection Resin," Euclid Chemical Company
"Sure-Inject (J-56)," Dayton Superior
"Epofil SLV", BASF Building Systems
"ETI-LV" or "ETI-GV", Simpson Strong-Tie Co., Inc. – injection type
"Pro-Poxy 100 LV" or "Pro-Poxy 50", Unitex
"Crackbond", U.S. Anchor Corp.
"Rezi-Weld LV", W. R. Meadows

"US Spec Maxibond" US Mix Co. – injection or gravity feed
"US Spec Eposeal LVS", US Mix Co. – gravity feed
"Duralcrete LV", Tamms Industries

2. Products for Epoxy Mortar Patches:

"Sikadur Lo-Mod LV"; Sika Chemical Corporation
"Euco 352 LV," Euclid Chemical Company
"Sure Grip Epoxy Grout (J-54)," Dayton-Superior
"Epofil", BASF Building Systems
"Pro-Poxy 2500", Unitex
"Rezi-Weld 1000", W. R. Meadows
"US Spec EPM 3000", US Mix Co.
"Duralcrete LV", Tamms Industries

3. Products for Epoxying Steel Plates to Concrete: Conform to ASTM C 881-90, Type IV, Grade 3, Class A, B, & C except gel times.

"Sikadur 31 Hi-Mod Gel"; Sika Corporation
"Euclid 452 Gel," Euclid Chemical Company
"Sure Anchor I (J-S1)," Dayton Superior
"Epo Gel" or "Rapid Gel", BASF Building Systems
"Pro-Poxy 300", Unitex
"US Spec Gelbond NS" US Mix Co.
"Duralcrete Gel", Tamms Industries

4. Products for Adhesive Anchors or Reinforcing Steel in Normalweight Concrete: Product that conforms to ASTM C 881-02, Type IV, Grade 3, Class A, B, & C except gel times, and that is dispensed from a two-component cartridge system through a mixing nozzle that thoroughly mixes the two components as it is injected into the hole. The product must show certification by the ICC Evaluation Service of having passed Acceptance Criteria 308 as evidenced by an Evaluation Service Report (ESR). Consult with the manufacturer for the minimum temperature of the concrete surface allowed.

a. Normal weight Concrete:

"HIT-RE 500-SD", Hilti Fastening Systems
"SET-XP" Adhesive", Simpson Strong-tie
"PE 1000+", Powers Fasteners, Inc.

b. Lightweight Concrete:

No approved products

c. These products may not be used in concrete cast over corrugated deck.

D. Self-Leveling Mortars, Underlayment Compound: Freeflowing, self-leveling, pumpable cementitious base compound. Follow manufacturer's instruction regarding the use of a bonding agent.

Products: Unless specified otherwise, provide one of the following:

"Sonoflow," BASF Building Systems
"Sikatop 111"; Sika Chemical Co.
"Flo-Top" or "Flo-Top 90"; Euclid Chemical Co.

"Levelayer I," Dayton Superior
"US Spec Self-leveling Underlayment" US Mix Co.
"Level Magic", Tamms Industries

E. Polymer Patching Mortar: Polymer and microsilica modified cementitious based compounds.

Products:

Horizontal Application

"Thin Top Supreme, Concrete Top Supreme," Euclid Chemical
"Sikatop 121 or 122," Sika Chemical
"Emaco R310 CI," BASF Building Systems
"Sonopatch 100 or 200", BASF Building Systems
"US Spec H2 or NuTop" US Mix Co.
"Speed Crete PM", Tamms Industries

Vertical or Overhead Application

"Verticoat/Verticoat Supreme," Euclid Chemical
"Sikatop 123," Sika Chemical
"Emaco R350 CI," BASF Building Systems
"Sonopatch 200", BASF Building Systems
"US Spec V/O Patch", US Mix Co.
"Speed Crete PM", Tamms Industries

F. High Strength Flowing Repair Mortar: For forming and pouring structural members, or large horizontal repairs, provide flowable one-part, high strength microsilica polymer modified repair mortar with 3/8" aggregate. The product shall achieve 9000 psi @ 28-days at a 9-inch slump.

Products:

"Road Patch", BASF Building Systems
"US Spec STR Mortar", US Mix Co.
"Eucocrete", Euclid Chemical Co.
"Form and Pour", Tamms Industries

G. Expansion Anchors in Concrete:

1. ICC Approval: Only anchors evaluated by the ICC Evaluation Service, Inc. (ICC-ES) with a published Evaluation Report showing having passed Acceptance Criteria 193 and approval for use in cracked concrete and resisting wind and seismic loads shall be approved for use.

2. Type: All expansion anchors in concrete shall be only wedge type expansion, sleeve-type expansion, or undercut type anchors.

3. Interior Use: All expansion anchors, nuts and washers for use in interior conditioned environments free of potential moisture shall be manufactured from carbon steel zinc plated in accordance with Federal Specification QQ-Z-325C, Type II, Class 3.

4. Exterior or Exposed Use: All expansion anchors, nuts and washers for use in exposed or potentially wet environments, or for attachment of exterior cladding materials shall be galvanized or stainless steel. Galvanized anchors, nuts and washers shall conform to

ASTM A 153. Stainless steel anchors shall be manufactured from 300 series stainless steel and nuts and washers from 300 series or Type 18-8 stainless steel.

5. Nuts and Washers: Nuts and washers shall be furnished from the manufacturer and used with the anchors.

6. Acceptable Products and Manufacturers – Normal and Lightweight Concrete:

"Kwik Bolt TZ", "HDA Undercut Anchor" and "HSL-3 Heavy Duty Sleeve Anchor", Hilti Fastening Systems
"Strong-Bolt Wedge Anchor", Simpson Strong-Tie, Co., Inc
"Red Head Trubolt + Wedge Anchor", ITW Red Head
"DUC Undercut Anchor", USP Structural Connectors
"Power Stud + SD2", Powers Fasteners, Inc
"SRS TZ Carbon Steel Anchor", MKT Metall-Kunststoff-Technik
"Torq-Cut Self Undercutting Anchor", Simpson Strong-Tie, Co. Inc. (ESR Pending)

7. Acceptable Products and Manufacturers – Normal and Light Weight Concrete on Corrugated Deck:

"Kwik Bolt TZ", Hilti Fastening System
Strong-Bolt Wedge-Anchor", Simpson Strong-Tie, Co, Inc.
Power Stud + SD2", Powers Fasteners, Inc.

H. Screw Anchors in Concrete

1. Approvals: Only anchors evaluated by the ICC Evaluation Service, Inc. (ICC-ES) with a published Evaluation Report showing having passed Acceptance Criteria 193 and approved for use in cracked concrete and resisting wind and seismic loads shall be approved for use.

2. Interior Use: All screw anchors for use in interior conditioned environments free of potential moisture shall be manufactured from carbon steel zinc plated in accordance with Federal Specification QQ-Z-325C, Type II, Class 3.

3. Exterior or Exposed Use: All screw anchors for use in exposed or potentially wet environments, or for attachment of exterior cladding materials shall be galvanized or stainless steel. Galvanized anchors shall conform to ASTM A 153. Stainless steel anchors shall be manufactured from 300 series stainless steel.

4. Acceptable Products and Manufacturers – All Conditions:

"Titen HD", Simpson Strong-Tie Co., Inc
"Snake+Anchor" Powers Fasteners, Inc.
"Wedge-Bolt+", Powers Fasteners, Inc. (greater than ¼ in. diameter)

I. Contraction and Construction Joint-Filler Material for Slabs-on-Grade: Provide a 2-component semi-rigid, 100% solids epoxy having a minimum shore A hardness of 80 when tested in accordance with ASTM D 2240. Provide one of the following:

"Euco 700", Euclid Chemical Co., Inc.

"Spec-Joint CJ"; Conspec Marketing and Manufacturing Co., Inc.
"Masterfill 300 I", BASF Building Systems
"MM-80", Metzger/McGuire Co.
"Rezi-Weld Flex", W. R. Meadows
"US Spec SR-50 EJF", US Mix Co.

J. Bondbreaker for Construction Joints in Slabs-on-Grade: A dissipating bondbreaking compound containing no silicones, resins, or waxes, and that conforms to ASTM C 309. Acceptable manufacturers include the following:

"Sure-Lift", Dayton Superior Corporation, Inc.
"Tilt-Eez", Conspec Marketing and Manufacturing Co., Inc.

K. Joint-Filler Strips for Isolation Joints in Slabs-on-Grade: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork

2.3 PROPORTIONING AND DESIGN OF CONCRETE MIXES

A. The Contractor shall submit concrete mix designs and the Concrete Mix Design Submittal Form located at the end of this specification section for each class of concrete indicated on the structural drawings and in the Specifications for approval by the Design Professional and Design Professional's Testing Laboratory at least 15 working days prior to the start of construction,. If required, the Contractor shall engage the services of an independent Testing Laboratory to assist in preparing the mix design. The Contractor shall not begin work with a particular mix until that mix design has been approved.

B. The Contractor, acting in conjunction with his Concrete Supplier and his Testing Laboratory, shall submit in writing, with his mix designs, the method used to select mix proportions. Either of the following methods, as outlined in ACI 301, may be used.

1. Field Experience Method

2. Laboratory Trial Mixture Method

C. Required types of concrete and compressive strengths shall be as indicated on the Structural Drawings.

D. All mix designs shall state the following information:

1. Mix design number or code designation by which the Contractor shall order the concrete from the Supplier.

2. Structural slab or member for which the concrete is designed (i.e., columns, shear walls, footings, slab on grade, etc.).

3. Wet and dry unit weight.

4. 28 day compressive strength.

5. Aggregate type, source, size, gradation, fineness modulus.

6. Cement type and brand.

7. Fly ash or other pozzolan type and brand (if any).

8. Admixtures including air entrainment, water reducers, high-range water reducers, accelerators, and retarders.

9. Design Slump or Slump/Flow.

10. Proportions of each material used.

11. Water/cementitious ratio and maximum allowable water content.

12. Method by which the concrete is intended to be placed (bucket, chute, or pump).

13. Required average strength qualification calculations per ACI 301 4.2.3.3a and 4.2.3.3b. Submit separate qualification calculations for each production facility that will supply concrete to the project.

14. Documentation of Average strength (trial mix data or field test data) per ACI 301: When field test data is used to qualify average strength, submit separate documentation for each production facility that will supply concrete to the project.

15. Field test data submitted for qualification of average strength under ACI 301 shall include copies of the Concrete Testing Agency's reports from which the data was compiled.

16. All other information requested in the Concrete Mix Design Submittal Form located at the end of this specification section.

E. Supplementary Cementitious Materials: Fly ash replacement of Portland cement shall not exceed 25% unless otherwise approved. If fly ash is used, it must be at a minimum fly ash replacement level of 15%. Slag cement replacement of Portland cement shall not exceed 50% unless otherwise approved. Approval for higher levels will be based on showing experience of satisfactory performance on other projects using materials from identical sources as proposed for this project. Submit evidence of such experience on other projects.

F. Aggregate: Comply with the following special requirements:

1. For slabs and other designated concrete, combined aggregate gradation shall be 8% - 18% for large top size aggregates (1 1/2 in.) or 8% - 22% for smaller top size aggregates (1 in. or 3/4 in.) retained on each sieve below the top size and above the No. 100. Deviations from this gradation may be allowed upon the approval of the Design Professional subject to the following limitations:

   a. The percent retained on two adjacent sieves shall be not less than 5%.
   b. The percent retained on three adjacent sieves shall be not less than 8%
   c. If the percent retained on two adjacent sieves is less than 8%, the total percent retained on either of those sieves and the adjacent outside sieve shall be not less than 13 %

G. Admixtures:

1. Admixtures to be used in concrete shall be subject to the approval of the Design Professional and shall be used for the purpose intended by the manufacturer to produce concrete to meet the specified requirements.

2. Quantities of admixtures to be used shall be in strict accordance with the manufacturer's instructions.

H. Adjustments of Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Such mix design adjustments shall be provided at no additional cost to the Owner. Any adjustments in approved mix designs including changes in admixtures shall be submitted in writing with the specified Concrete Mix Design Submittal Form to the Design Professional and Design Professional's Testing Laboratory for approval prior to field use.

I. Shrinkage: Concrete so identified on the drawings shall be proportioned for a maximum allowable unit shrinkage as noted on the drawings, measured at 28 days after curing in lime water as determined by ASTM C 157 (using air storage). Submit results of test for each class of applicable concrete after every 500 cy. placed.

J. Chloride Ion Content: A written submittal shall be made with each mix design proposed for use on the project that the chloride ion content from all ingredients including admixtures will not exceed the limits specified in this section of the Specifications.

2.4 CONCRETE MIXES

A. Ready-Mix Concrete: Comply with requirements of ANSI/ASTM C 94, "Ready Mixed Concrete" and Testing Laboratory section of the specifications.

PART 3 - EXECUTION

3.1 SLUMP LIMIT

A. The slump, as measured in the field where concrete cylinders are taken, shall be within plus or minus 1 inch of the design slump noted on the Mix Design Submittal Form. Self-consolidating concrete shall have a slump/flow of plus or minus 2 inches of the design slump noted on the Mix Design Submittal Form. Water may be added to the concrete in the field only to the extent that the prescribed water/cementitious ratio noted in the Mix Design Submittal Form is not exceeded.

3.2 VAPOR BARRIER INSTALLATION

A. Install vapor barrier in accordance with ASTM E 1643 and manufacturer's instructions.

B. Seal all joints in the field with the specified pressure sensitive tape. Heat-welded joints done in a shop prior to delivery is an acceptable method to minimize the number of field joints.

C. Seal all pipe penetrations through the moisture retarder with a boot made from the moisture retarder material and tape.

3.3 JOINTS IN CONCRETE

A. Construction Joints: Locate and install construction joints as indicated on the drawings or if not shown on drawings, located so as not to impair strength and appearance of the structure, as acceptable to Design Professional.

1. Keyways: Provide keyways with a depth of one tenth of the member thickness (1 1/2" minimum or as shown on the drawings) in construction joints only where shown on the drawings.

2. Joint Construction: Place construction joints in the center one third of suspended spans and grade beams and as shown on the drawings for slabs-on-grade and walls unless shown otherwise. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise shown on the drawings. Dowels that cross construction joints shall be supported during concreting operations so as to remain parallel with the slab or wall surface and at right angles to the joint. Submit all construction joint locations as a shop drawing submittal.

3. Waterstops: Provide waterstops in construction joints as indicated on the Architectural and Structural Drawings. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions.

4. Isolation Joints in Slabs-on-Ground: Construct isolation joints (without dowels) in slabs-on-ground at points of contact between slabs on ground and vertical surfaces only where specifically detailed on the drawings. Install joint-filler strips at joints where indicated. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated on the drawings. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together. Provide construction joints with dowels at all locations unless isolation joints are detailed.

5. Contraction (Control) Joints in Slabs-on-Ground : Maximum joint spacing shall be 36 times the slab thickness or 20 feet, whichever is less and at a minimum on column lines unless otherwise noted on the drawings. Use one of the two following methods (sawed or formed) to create the joints. Do not use the formed joint in areas subject to vehicular traffic.

    a. Sawed Joints
        (1) Primary Method: Early-Entry, dry-cut method, by Soff-Cut International, Corona, CA (800) 776-3328. Finisher must have documented successful experience in the use of this method prior to this project. Install cuts within 1 to 4 hours, depending on air temperature, after final finish as soon as the concrete surface is firm enough to not be torn or damaged by the blade at each saw cut location. Use 1/8 inch thick blade, cutting 1 1/4" inch into the slab.
        (2) Optional Method (where Soff-Cut System method equipment is not available, subject to limitations): This method may not be used when there is no dowel passing through the contraction joint. Use a conventional saw to cut joints within 4 to 12 hours after finishing as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw. Complete cutting before shrinkage stresses become sufficient to produce cracking. Use 1/8 inch thick blade, cutting to a depth of 1/4 of the slab thickness but not less than 1 inch. Cut to a depth of 1/3 slab thickness for slabs reinforced with steel fibers.

    b. Formed Joints: Form contraction joints by inserting premolded plastic hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. The depth is to be 1/4 the slab thickness, but not less than 1 inch. Tool

slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

c. Joint Filler: Provide in both contraction and saw-cut construction joints when specified.
   (1) Remove dirt and debris from the joint by vacuuming immediately prior to filling joint. Clean the joint of curing compounds and sealers.
   (2) Filler material shall be applied to the joints when the building is under permanent temperature control, but no less than 90 days after slab construction.
   (3) Follow the manufacturer's recommended procedure for installing filler material. The joint filler must be flush with the adjacent concrete. A concave profile on the top of the joint filler is unacceptable and will be grounds for removal and replacement.

d. The Contractor shall protect the joints from damage caused by wheeled traffic or other sources during construction until a joint-filler material (if specified) has been installed.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto unless directed otherwise by these specifications. Install reglets to receive top edge of foundation sheet waterproofing where specified by the Architect, and to receive thru-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles and other conditions.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

C. Do not install sleeves in concrete slabs, pier caps, footings or walls except where shown on the structural drawings or approved by the Design Professional.

D. Securely fasten embedded plates, angles, anchor rods and other items to be built into the concrete to the formwork or hold in place with templates. Insertion of these items into concrete after casting is prohibited.

3.5 CONCRETE PLACEMENT

A. Preplacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

B. Coordinate the installation of joint materials and vapor barriers with placement of forms and reinforcing steel.

C. Comply with ACI 301 and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction

joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation. Spread concrete using short-handled, square-ended shovels, or come-alongs.

2. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

3. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use internal vibrators of the largest size and power that can properly be used in the work as described in the table entitled "Range of characteristics, performance, and applications of internal vibrators" found in ACI 301.

4. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

5. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed. Place concrete for beams, girders, brackets, column capitals, haunches, and drop panels at the same time as concrete for slabs. Do not place concrete over columns and walls until concrete in columns and walls is no longer plastic and has been in place at least one hour.

6. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners of forms, eliminating air and stone pockets that may cause honeycombing, pitting, or planes of weakness.

7. Bring slab surfaces to correct level with straightedge and strikeoff. Use highway straightedges, bull floats or darbies to smooth surface free of humps or hollows before excess moisture or bleedwater appears on the surface. Do not disturb slab surfaces prior to beginning finishing operations.

8. Maintain reinforcing in proper position during concrete placement operations.

9. Placing Concrete by Pump: If concrete is placed by using a pump, the grout used for pump priming must not become a part of the completed structure unless an engineered grout design mix and grout location are approved in advance by the **Design Professional.**

3.6 FINISH OF FORMED SURFACES

A. Smooth Form Finish: Provide smooth form finish for formed concrete surfaces as scheduled on the drawings, which may include those exposed-to-view, or that are to be covered with a coating or covering material applied directly to concrete such as waterproofing, dampproofing, painting, veneer plaster or other similar system, or to a surface that is to receive a smooth rubbed finish or grout cleaned finish. This is an as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections exceeding 1/8 inch in height removed and smoothed.

B. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled or specified concrete surfaces, which have received smooth-form finish treatment, not later than one day after form removal. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.7 MONOLITHIC SLAB FINISHES

Place, consolidate, strike off, and level concrete, eliminating high spots and low spots, before proceeding with any other finish operation. Do not add water to the surface of the concrete during finishing operation.

A. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated. After screeding, consolidating and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using a hand float, a bladed power float equipped with float shoes, or a powered disk float, when the bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit the operation. Check and level surface plane to a tolerance as specified below. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

B. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thin film finish coating system. After floating, begin first trowel finish operation by hand or power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a level surface to a tolerance as specified below. Grind smooth surface defects which would telegraph through applied floor covering system.

3.8 CONCRETE FINISH MEASUREMENT AND TOLERANCES

A. Testing Procedure: ASTM E 1155

B. Tolerance on Floor Elevations: Construction tolerance on absolute floor elevation from the specified elevation as shown on the drawings shall be as specified below, taken from ACI 117:

1. Slab-on-Grade Construction - $\pm$ 3/4".

2. Top surfaces of formed slabs measured prior to removal of supporting shores - $\pm$ 3/4".

3. Top surfaces of all other slabs - $\pm$ 3/4".

C. Random Traffic Floor Finish Tolerances:

1. Specified overall values for flatness (SOF_F) and levelness (SOF_L) shall conform to the values listed below for the floor surface classification noted for each slab category noted.

Floor Surface Classification	SOF_F	SOF_L
Conventional (Typical Floors)	20	15
Flat (Shop areas)	35	25

2. Minimum local values for flatness (MLF_F) and levelness (MLF_L) shall equal 3/5 of the SOF_F and SOF_L values, respectively, unless noted otherwise. The MLF_F and MLF_L values shall apply to the minimum areas bounded by the column lines and half-column lines, or the minimum areas bounded by the construction and contraction joints, whichever are the smaller areas.

3. The SOF_L and MFL_L tolerance values shall apply only to level slabs-on-ground or to level, uncambered suspended slabs that are shored such that it cannot deflect from the time the floor is placed to the time it is measured.

4. Slabs specified to slope shall have a tolerance from the specified slope of 3/8" in 10 feet at any point.

D. Construction Requirements to Achieve Specified Floor Finish Tolerances:

1. Forms shall be properly leveled, in good condition and securely anchored including special attention to ends and transitions.

2. Bearing surfaces for straightedges such as form edges or previously poured slabs shall be kept clean of laitance, sand, gravel, or other foreign elements.

3. Screeds shall be maintained in good condition with true round rolling wheels and level cutting edges. The use of optical sighting equipment such as lasers is recommended for checking levelness and straightness. The Contractor shall promptly adjust or replace equipment when test results indicate substandard work.

4. Highway straightedges are recommended for use in lieu of bullfloats for all slab placement and finishing operations.

E. Contractor Responsibility for Concrete Floor Finish Requirements: Floor finish requirements shown below (flatness and levelness tolerances) are minimum requirements that apply unless stricter requirements are contained in instructions for installation of applied floor products in which case the Contractor is responsible for attaining the values prescribed by the manufacturer of such products.

F. Concrete Floor Finish Tolerance for Slab-on-Grade Construction:

1. Concrete Placement: Concrete shall be placed and screeded to predetermined marks set to elevations prescribed on the drawings.

2. Finish Tolerances of Random Traffic Floor Surfaces:

a. Slabs in nonpublic areas, mechanical rooms, surfaces to received raised computer flooring, surfaces to have thick-set tile or a topping, and parking structures: Conventional

G. Concrete Floor Finish Tolerance for Shored, Cast-in-Place Suspended Slab Construction:

1. Concrete Placement: Formwork shall be set and securely braced so that soffits are positioned to allow scheduled concrete member sizes and thicknesses within tolerances specified in ACI 117. Concrete shall be placed and screeded to predetermined marks on the form surface conforming to elevations prescribed on the drawings.

2. Camber: Formwork camber, as indicated on the drawings, shall be set to provide a uniform, smooth soffit profile in each direction. Minimum slab thickness, as specified on the drawings, shall be maintained throughout the slab surface to a tolerance as specified in ACI 117. Tolerance on camber shall be ± 1/4". Levelness F-Number tolerances specified below do not apply to areas of the floor where camber or intentional slope is shown.

3. Finish Tolerances of Random Traffic Floor Surfaces:

   a. Slabs in nonpublic areas, mechanical rooms, surfaces to received raised computer flooring, surfaces to have thick-set tile or a topping, and parking structures: Conventional

4. Extra Concrete: The contractor shall include in his bid any additional concrete required to achieve the specified slab surface finish tolerance.

H. Concrete Floor Finish Tolerance - Unshored Metal Deck on Shored or Unshored Steel Beam or Open-Web Joist Floor Construction:

1. Concrete Placement: Concrete over metal deck shall be placed and screeded level and flat to the tolerance specified below, maintaining at least the minimum slab thickness at all locations as specified on the drawings. The Contractor shall increase the slab thickness as required to compensate for metal deck deflection, and in unshored beam construction, residual beam camber and beam deflection in order to achieve a level and flat floor within specified tolerances.

2. Finish Tolerance of Random Traffic Floor Surfaces:

   a. Slabs in nonpublic areas, mechanical rooms, surfaces to received raised computer flooring, surfaces to have thick-set tile or a topping, and parking structures: Conventional
   b. Eighty percent (80%) of the final floor surface shall fall within an envelope of 0.75" centered about the mean elevation of all the readings. (± 0.375 about mean). The mean elevation of all readings shall not deviate from the specified design grade by more than ± 0.375".

3. Extra Concrete: The contractor shall include in his bid any additional concrete required to achieve the specified slab surface finish tolerance and to compensate for metal deck deflection, beam camber and beam deflection.

I. Remedial Measures for Slab Finish Construction Not Meeting Specified Tolerances:

1. Application of Remedial Measures. Remedial measures specified herein are required whenever either or both of the following occur:

   a. The composite overall values of F_F or F_L of the entire floor installation measure less than specified values.

b. Any individual test section measures less than the specified absolute minimum F_F or F_L value.

2. Modification of Existing Surface:

a. If, in the opinion of the Design Professional or Design Professional's Representative, all or any portion of the substandard work can be repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately undertake the approved repair method.
b. The Contractor shall submit for review and approval a detailed work plan of the proposed repair showing areas to be repaired, method of repair and time to affect the repair.
c. Repair method(s), at the sole discretion of the Design Professional or Design Professional's Representative, may include grinding (floor stoning), planing, retopping with self leveling underlayment compound or repair topping, or any combination of the above.
d. The Design Professional or Design Professional's Representative maintains the right to require a test repair section using the approved method of repair for review and approval to demonstrate a satisfactory end product. If, in the opinion of the Design Professional or Design Professional's Representative, the repair is not satisfactory an alternate method of repair shall be submitted or the defective area shall be replaced.
e. The judgment of the Design Professional or Design Professional's Representative on the appropriateness of a repair method and its ability to achieve the desired end product shall be final.
f. All repair work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

3. Removal and Replacement:

a. If, in the opinion of the Design Professional or Design Professional's Representative, all or any portion of the substandard work cannot be satisfactorily repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately commence to remove and replace the defective work.
b. Replacement section boundaries shall be made to coincide with the test section boundaries as previously defined.
c. Sections requiring replacement shall be removed by sawcutting along the section boundary lines to provide a neat clean joint between new replacement floor and existing floor.
d. The new section shall be reinforced the same as the removed section and doweled into the existing floor as required by the Design Professional. No existing removed reinforcing steel may be used. All reinforcing steel shall be new steel.
e. Replacement sections may be retested for compliance at the discretion of the Design Professional or Design Professional's Representative.
f. The judgment of the Design Professional or Design Professional's Representative on the need for replacement shall be final.
g. All replacement work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

3.9 CONCRETE CURING AND PROTECTION

A. General:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Maintain concrete with minimal moisture loss at a relatively constant

temperature for the period necessary for hydration of the cement and hardening of concrete. Apply evaporation retarder if hot, dry and windy weather causes moisture loss exceeding 0.2 lb./sq. ft. x hr before and during finishing operations.. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

2. Curing shall commence as soon as free water has disappeared from the concrete surface after placing and finishing. The curing period shall be 7 days for all concrete except high early strength concrete which shall be cured for 3 days minimum.

   Alternatively, curing times may be reduced if either of the following provisions is complied with:

   a. If tests are made of cylinders kept adjacent to the structure and cured by the same methods, curing measures may be terminated when the average compressive strength has reached 70% of the specified 28 day compressive strength.
   b. If the temperature of the concrete is maintained at a minimum of 50°F for the same length of time required for laboratory cured cylinders of the same concrete to reach 85% of the 28 day compressive strength, then curing may be terminated thereafter.

3. Curing shall be in accordance with ACI 301 procedures. Avoid rapid drying at the end of the curing period.

B. Curing Formed Surfaces: Where wooden forms are used, cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. When forms are removed, continue curing by one or a combination of the methods specified below, as applicable.

1. Sides and Soffits of Beams and Pan-Joist Ribs, Soffits of Slabs: Moist cure in forms or by one or a combination of methods 1, 2 or 3 specified below. Use a liquid membrane-forming dissipating resin curing compound conforming to ASTM C 309, type 1, class A or B for method 3.

C. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping and other flat surfaces by one or a combination of the methods specified below, as applicable. The Contractor shall choose a curing method that is compatible with the requirements for subsequent material usage on the concrete surface.

1. All Other Surfaces: Cure using methods 1,2 or 3 as specified below. Use a water-based dissipating resin type curing compound conforming to ASTM C 309, type 1, class A or B for method 3.

D. Curing Methods:

1. Method 1 - Moisture Curing: Provide moisture curing by one of the following methods:

   a. Keep concrete surface continuously wet by covering with water.
   b. Continuous water-fog spray.
   c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

2. Method 2 - Moisture-Retaining Cover Curing: Provide moisture-retaining cover curing as follows:

Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape. Water may be added to concrete surface to prevent drying before the cover is installed, but the surface shall not be flooded with water if a non-absorptive cover is used.

3. Method 3 – Curing or Curing and Sealing Compound: Provide curing, curing/hardener, liquid membrane-forming curing, or curing and sealing compound as follows:

   Apply specified compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Do not allow to puddle. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period. Apply second coat for sealing 2 to 3 hours after the first coat was applied.

   Do not use membrane-forming curing and sealing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glued-down carpet, vinyl composition tile, linoleum, sheet vinyl, rubber, athletic flooring, synthetic turf, or wood), paint or other coatings and finish materials. Dissipating resin type cures are acceptable in these locations.

3.10 HOT OR OTHER ADVERSE WEATHER CONCRETING

A. Definition:

1. Conditions warranting hot weather concreting practices are defined as any combination of high air temperature, low relative humidity and wind velocity tending to impair the quality of fresh or hardened concrete or otherwise result in abnormal properties. If conditions cause an evaporation rate of 0.2 lb./sq. ft./hr. as calculated by Figure 2.1.5 in ACI 305R-99, then precautions shall be taken to prevent plastic shrinkage cracks from occurring.

2. The maximum acceptable concrete temperature at the truck discharge point shall be 95°F.

B. Specification: Follow hot weather concreting practices specified below when required to limit the concrete temperature at the truck discharge point to the stated maximum acceptable temperature.

C. Records: Under hot weather conditions, the Contractor shall keep records of outside air temperature, concrete temperature at truck discharge and general weather conditions.

D. Hot Weather Concreting Requirements: The following items, all or in part as required, shall be followed to limit the concrete temperature to the stated maximum acceptable temperature and to minimize the possibility of plastic shrinkage cracks from developing.

1. Design the concrete mixes specifically for hot weather conditions replacing some cement with fly ash or other pozzolan and using a water reducing retarding admixture (ASTM C 494 Type D).

2. Use the largest size and amount of coarse aggregate compatible with the job.

3. Use sunshades and/or windbreaks.

4. Delay construction of indoor slabs-on-grade until the walls and roof are constructed.

5. Cool and shade aggregate stockpiles.

6. Use ice as part of the mixing water or cool the water with liquid nitrogen.

7. Limit the number of revolutions at mixing speed to 125 maximum.

8. Reduce time between mixing and placing as much as possible.

9. Do not add water to ready-mixed concrete at the job site unless it is part of the amount required initially for the specified water-cement ratio and the specified slump.

10. Schedule concrete placement for early morning, late afternoon, or night.

11. Have all forms, equipment and workers ready to receive and handle concrete.

12. Maintain one standby vibrator for every three vibrators used.

13. Keep all equipment and material cool by spraying with water including exteriors of forms, reinforcing steel, subgrade, chutes, conveyors, pump lines, tremies, and buggies.

14. Protect slab concrete at all stages against undue evaporation by applying a fog spray or mist above the surface or applying a monomolecular film. Where high temperatures and/or placing conditions dictate, use water-reducing retarding admixture (Type D) in lieu of the water-reducing admixture (Type A) as directed by the Design Professional's Testing Laboratory.

15. Provide continuous curing, preferably with water, during the first 24 hours using wet burlap, cotton mats, continuous spray mist, or by applying a curing compound meeting ASTM C 1315. Continue curing for 3 days minimum.

16. Cover reinforcing steel with water soaked burlap so that steel temperature will not exceed ambient air temperature immediately before placement of concrete.

17. As soon as possible, loosen forms and run water down the inside. When forms are removed, provide a wet cover to newly exposed surfaces.

3.11 COLD OR OTHER ADVERSE WEATHER CONCRETING

A. Definition:

1. Concrete shall not be placed when the outside air temperature is 40°F or less unless cold weather concreting practices are followed as specified below.

2. Cold weather concreting practices should also be followed whenever the average daily air temperature is less than 40°F for more than three successive days. The average daily air temperature is the average of the highest and lowest temperature occurring during the period from midnight to midnight. The requirement for adhering to these cold-weather concreting practices may be terminated when the air temperature is above 50° F for more than half of any 24h duration.

3. The temperature of the concrete immediately after placing shall be no less than and no more than 20° greater than the following temperature:.

   a. 55° F for sections less than 12 in. in the least dimension
   b. 50° F for sections 12 to 36 in. in the least dimension
   c. 45° F for sections 36 to 72 in. in the least dimension
   d. 40° F for sections greater than 72 in. in the least dimension

4. Protect the concrete immediately after placing and during the curing period such that the concrete does not freeze nor fall below the temperature levels stated in the above paragraph. When removing protection, the maximum decrease in temperature measured at the surface of the concrete in a 24 hour period shall not exceed the following:

   a. 50° F for sections less than 12 in. in the least dimension
   b. 40° F for sections 12 to 36 in. in the least dimension
   c. 30° F for sections 36 to 72 in. in the least dimension
   d. 20° F for sections greater than 72 in. in the least dimension

5. The maximum concrete temperature heated by artificial means at point of placement shall not exceed 90°F.

B. Records: Under cold weather conditions, the Contractor shall keep records of outside air temperature, concrete temperature as placed and general weather conditions.

C. Cold Weather Concreting Requirements: The following items, all or in part as required, should be followed to assure acceptable concrete in cold weather conditions:

1. Design the concrete mix suitable for cold weather. Use air entrainment (where not prohibited) and obtain high early strength by using a higher cement content, a high early strength cement (Type III), or a specified non-chloride accelerator (ASTM C 494 Type C or E).

2. Protect the concrete during curing period using insulating blankets, insulated forms, enclosures and/or heaters.

3. Concrete cured in heated enclosures shall have heaters vented to prevent exposure of concrete and workmen to noxious gases.

4. Frozen subgrade shall be thawed prior to concrete placement and snow and ice shall be removed from forms.

5. Concrete shall be protected and cured at 50°F for seven days minimum if normal concrete (Type I cement) is used and for three days minimum if high early strength concrete (concrete with Type III cement, 100 pounds cement added per cubic yard concrete, or a non-chloride accelerator added).

6. Concrete not loaded during construction shall be protected a minimum of 3 days for normal concrete and 2 days for high early strength concrete to obtain safe form stripping strength. Concrete fully loaded during construction shall be protected for whatever time period is required to obtain the required strength as determined by nondestructive strength tests (Windsor probe, Swiss Hammer Test) on the in-place concrete.

7. Heat the mixing water and then blend hot and cold water to obtain concrete no more than 10°F above the required temperature.

8. Heat the aggregates by circulating steam in pipes placed in the storage bins for air temperatures consistently below 32°F. When either water or aggregate is heated to over 140°F combine them in the mixer first to obtain a maximum temperature of the mixture not to exceed 140°F in order to prevent flash set of the concrete.

9. Uniformly thaw aggregates far in advance of batching to prevent moisture variations in the stockpile.

10. Cover warmed stockpiles with tarps to retain heat.

11. Place air entraining admixture in the batch after the water temperature has been reduced by mixing with cooler solid materials.

12. Use wind screens to protect concrete from rapid cooling.

13. Place vertical pump lines inside the building, if possible, for concrete being pumped.

14. Maintain artificial heat as low as possible to reduce temperature stresses during cooling.

15. Avoid water curing of concrete except for parking garage structures. Apply the required curing compound to unformed surfaces as soon as possible to prevent drying of concrete from heated enclosures.

16. Delay form stripping as long as possible to help prevent drying from heated enclosures and to reduce damage to formed surfaces caused by premature stripping.

17. Provide triple thickness of insulating materials at corners and edges vulnerable to freezing.

18. Wrap protruding reinforcing bars with insulation to avoid heat drain from the warm concrete.

19. Gradually reduce the heat at the end of the heating period to reduce likelihood of thermal shock.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor rods for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

D. Installation of Adhesive Anchors Using Injectable Epoxy or Adhesive: A representative of the adhesive manufacturer shall be present for the first three holes that are drilled and filled with adhesive. After drilling the hole to the diameter and depth recommended by the manufacturer,

clean the hole with a wire or nylon brush. Blow the dust out of the hole using compressed air with a nozzle that reaches to the bottom of the hole. When using adhesive from a new pack, the adhesive that is discharged from the mixing nozzle should be a uniform gray color before any adhesive is installed in the hole. Fill the hole with adhesive starting from the very bottom of the hole until the hole is about 2/3 full. Do not leave an air pocket at the bottom of the hole. Insert the anchor rod or dowel by slowly twisting it into the hole.

3.13 CONCRETE SURFACE REPAIRS

A. Definition - Defective Areas:

1. Formed Surfaces: Concrete surfaces requiring repairs shall include all honeycombs, rock pockets and voids exceeding 1/4" in any dimension, holes left by tie rods or bolts, cracks in excess of 0.01" and any other defects that affect the durability or structural integrity of the concrete.

2. Unformed Surfaces: Concrete surfaces requiring repair shall include all surface defects such as crazing, cracks in excess of 0.01" wide or cracks which penetrate to reinforcement or through the member, popouts, spalling and honeycombs.

B. Classification:

1. Structural Concrete Repair: Major defective areas in concrete members that are load carrying (such as shear walls, beams, joists and slabs), are highly stressed, and are vital to the structural integrity of the structure shall require structural repairs. Structural concrete repairs shall be made using a two-part epoxy bonder, epoxy mortar or specified polymer repair mortar. The Design Professional shall determine the locations of required structural concrete repairs.

2. Cosmetic Concrete Repair: Defective areas in concrete members that are non-load carrying and minor defective areas in load carrying concrete members shall require cosmetic concrete repair when exposed to view and not covered up by architectural finishes. Cosmetic concrete repairs may be made using a polymer repair mortar and compatible bonding agent. The Design Professional shall determine the locations of required cosmetic concrete repairs. Stains and other discolorations that cannot be removed by cleaning and are exposed to view will require cosmetic repair. Cosmetic concrete repair in exposed-to-view surfaces will require Architect's approval prior to patching operation.

3. Slab Repairs: High and low areas in concrete slabs shall be repaired by removing and replacing defective slab areas unless an alternate method, such as grinding and/or filling with self-leveling underlayment compound or repair mortar is approved by the Design Professional. Repair of slab spalls and other surface defects shall be made using epoxy products as specified above and as determined by the Design Professional. The high strength flowing repair mortar may be used for areas greater than 1 inch in depth.

3.14 QUALITY ASSURANCE TESTING AND INSPECTION DURING CONSTRUCTION

A. See Testing Laboratory Services section of these Specifications for concrete materials and cast-in-place concrete inspection and test requirements.

3.15 INVESTIGATION OF LOW CONCRETE STRENGTH TEST RESULTS

A. Contractor Responsibility for Low Strength Concrete:

1. If the average of any three consecutive strength tests falls below the required f'c for a class of concrete but no individual strength test is more than 500 psi below f'c, the Contractor shall immediately notify the Design Professional by telephone or e-mail and take immediate steps to increase the average of subsequent strength tests.

2. If any individual strength test falls more than 500 psi below the required f'c, the Contractor shall immediately notify the Design Professional by telephone or e-mail and take immediate steps to assure that the load-carrying capacity of the structure is not jeopardized.

B. Additional Field Tests to Confirm Low Concrete Strengths:

1. The cost of all investigations of low-strength concrete, as defined by any individual strength test being more than 500 psi below the required f'c, shall be borne by the Contractor.

2. Code-Prescribed Acceptance: The only accepted field-test methods of determining actual in-situ concrete strength is by the way of core tests as prescribed below.

3. Non-Destructive Tests: If any individual strength test falls more than 500 psi below the required f'c, the Design Professional may request that non-destructive field tests be performed on the concrete in question using Swiss Hammer, Windsor Probe, or other appropriate methods as approved by the Design Professional. Report the comparative test results of the suspect concrete under consideration with identical tests done on concrete of known strength and of the same class. The Design Professional considers these test results as only approximate indicators of strength and may not necessarily, by themselves, resolve the low concrete strength issue. These test results will be considered as additional information by which to make an informed judgment. The Design Professional reserves the right to accept the concrete based on the results of these approximate tests or order that core tests be taken as prescribed below. At the Contractor's option, the approximate non-destructive field-tests may be waived and core tests immediately initiated.

4. Core Tests: If, in the opinion of the Design Professional, the likelihood of low-strength concrete is confirmed and it has been determined that the load-carrying capacity of the structure is significantly reduced as a result, the Design Professional may request that core tests be taken from the area in question as directed by the Design Professional. There shall be a minimum of three cores taken for each strength test more than 500 psi below the required f'c and tested in accordance with ASTM C 42. If concrete in the structure will be dry under service conditions, cores shall be air dried (temperature 60° to 80°F, relative humidity less than 60 percent) for 7 days before test and shall be tested dry. If concrete in the structure will be more than superficially wet under service conditions, cores shall be immersed in water for at least 48 hours and tested wet. The Contractor shall fill all holes made by drilling cores with an approved drypack concrete.

5. Acceptance Criteria for Core Test: Concrete in an area represented by core tests shall be considered adequate if the average of three cores is equal to at least 85% of the required f'c and no single core is less than 75% of the required f'c. If approved by the Design Professional, locations of erratic core strengths may be retested to check testing accuracy.

6. Load Test: If the concrete strength is not considered adequate based on core tests and the structural adequacy remains in doubt, the Design Professional may order a load test as specified in ACI 318 be conducted for the questionable portion of the structure.

7. Strengthening or Demolition of the Structure: If the structural adequacy of the affected portion of the structure remains in doubt following the load test, the Design Professional may order the structure to be strengthened by an appropriate means or demolished and rebuilt at the Contractor's expense.

END OF SECTION

Date: _____

Concrete Mix Design
Submittal Form (Note 1)

I. Project Information
A. Name of Project: _____ B. City, State: _____
C. General Contractor: _____
D. Concrete Supplier: _____
1. Address: _____
2. Name to Contact: _____ 3. Phone No.: _____ 4. Fax No.: _____

II. Concrete Mix Information
A. Concrete Mix Design Designation (Note 2): _____
B. Minimum Concrete Strength f'c: _____ psi at _____ days and C. Maximum w/c Ratio:_____
D. Concrete Type (check one) _____NW _____LW E. Required Wet Weight: _____pcf
F. Concrete Use (member type as specified in General Notes): _____
G. Required Air Content: _____%
H. Method of Concrete Placement for this Mix:
(check one) _____ Bucket _____ Pump _____ Chute _____ Tremie _____ Other (Specify) _____

III. Method of Concrete Mix Design Preparation: (Check One Method Below) (Note 3)
A. _____ Field Experience Method B. _____ Trial Mixture Method

IV. Concrete Production Facility Information
A. Production facility has field strength test records of specified class or within 1 ksi of class: _____ Yes _____ No
Answer B thru C only if answer to IV.A. is "yes". If answer to IV.A. is "no", go to V.B.:
B. Test Record Information: (Check either 1, 2, or 3 below)
1. _____ ≥ 30 consecutive tests 2. _____ Two groups of ≥ 30 tests 3. _____ 15 to 29 tests
C. Standard Deviation S(PSI):
1. Modification Factor (if B.3. checked only. Ref. Table 5.3.1.2 of ACI 318-02.) MF = _____
2. Standard Deviation S = _____ psi 3. MF x S (if B.3. checked only) = _____ psi

Note: Combined aggregate gradation for slabs and other designated concrete shall be 8% -18% for large top size aggregates (1 ½ in.) or 8%-22% for smaller top size aggregates (1 in. of ¾ in.) retained on each sieve below the top size and above the No. 100 sieve.

V. Required Average Compressive Strength f'cr (psi)
A. Calculation of f'cr from S (fill out only if IV.A. is "yes) (larger of 1 or 2 below controls)
1. f'cr = f'c + 1.34 x S = _____ psi 2. f'cr = f'c + 2.33 x S - 500 = _____ psi
B. Calculation of f'cr from ACI 318-02 Table 5.3.2.2: (fill out if IV.A. is "No")
1. f'cr = f'c + _____ psi = _____ psi

VI. Concrete Mix Design by Field Experience Method: (fill out below only if III.A. is checked)
Note: This method requires one or more mix designs with a 45 day minimum field record of at least ten consecutive test results using similar materials and conditions as the proposed mix design.
A. Available field record is based on how many mix designs? _____ (specify number)
B. Average strength of field record is _____ psi (must be ≥ f'cr in V.)

VII. Concrete Mix Design by Trial Mixture Method: (fill out below only if III.B. is checked)
Note: This method requires using at least three different trial mixes with varying W/C ratios or cement contents with a plot of average strength vs. W/C ratio or cement content. Submit scale graph of results.
A. Trial Mixes: (Note: All other ingredients as specified in VIII. below)

	Mix 1	Mix 2	Mix 3	Selected (interpolated) values
Cements (lbs.)	_____	_____	_____	_____
W/C Ratio	_____	_____	_____	_____
Compressive Strength (psi) at Specified Days	_____	_____	_____	_____

VIII. Proposed Mix Design
A. Sources of Materials:
1. Cement: Type: _____ Manufacturer _____Lo-Alkali? Y N Sp. Gr._____
2. Fly Ash: Type: _____ Manufacturer _____ Sp. Gr._____
3. Silica Fume: Manufacturer: _____ Type (check one): ___ Slurry ___ Powder
Slurry: Specific Gravity _____ Water Content by Wt. _____% Silica by Wt. _____%
Powder: Specific Gravity _____ Silica by Wt. _____%
4. Coarse Aggregate: Size: _____ Type: _____ Source: _____ Ovendry Sp. Gr._____
(Note 4) Ovendry Rodded Density: _____ PCF Absorption: _____% (moist. content at SSD cond.)

5. Lightweight Agg.: _____ Size: _____ Type: _____ Source: _____ Ovendry Sp. Gr. (Note 4) Ovendry Rodded Density: _____ PCF Absorption: ____% (moist. content at SSD cond.)
6. Fine Aggregate: Type: _____ Source: _____ Fineness Modulus: _____ (Note 4) Ovendry Sp. Gr. _____ Absorption (moisture content at SSD condition): ____%
7. Air Entraining Agent (AEA): Manufacturer and Name: _____ ASTM No. _____

Note: Specify below all types and combinations of admixtures anticipated to be used for all anticipated weather conditions. Explain in (12) below.

8. Water Reducers (WR):
   a. (Plain) Manufacturer and Name: _____ ASTM No. _____
   b. (w/Accelerator) Manufacturer and Name: _____ ASTM No. _____
   c. (w/Retarder) Manufacturer and Name: _____ ASTM No. _____
9. Accelerators: Manufacturer and Name: _____ ASTM No. _____
10. Retarders: Manufacturer and Name: _____ ASTM No. _____
11. High Range Water Reducer (HRWR) (Superplasticizers):
    a. (Plain) Manufacturer and Name: _____ ASTM No. _____
    b. (w/Retarder) Manufacturer and Name: _____ ASTM No. _____
12. Comments: _____

B. Mix Proportions: (Per Cubic Yard)

Item	Wt. (lbs.)	Absolute Vol. (Cu. Ft.)		
1. Cement	_____	_____		
2. Fly Ash	_____	_____		
3. Silica Fume	_____	_____		
4. Coarse Agg. (SSD Wt.)	_____	_____		
5. Lightweight Agg. (SSD Wt.)	_____	_____		
6. Fine Agg. (SSD Wt.)	_____	_____		
7. AEA	_____ oz/100# cement		Added at: ___ Batch Plant ___ Site	
8. a. WR (Plain)	_____ oz/100# cement		Added at: ___ Batch Plant ___ Site	
b. WR (W/Acc.)	_____ oz/100# cement		Added at: ___ Batch Plant ___ Site	
c. WR (W/Ret.)	_____ oz/100# cement		Added at: ___ Batch Plant ___ Site	
9. Accelerator:	_____ oz/100# cement		Added at: ___ Batch Plant ___ Site	
10. Retarder:	_____ oz/100# cement		Added at: ___ Batch Plant ___ Site	
11. a. HRWR (Plain)	_____ oz/100# cement		Added at: ___ Batch Plant ___ Site	
b. HRWR (w/Ret.)	_____ oz/100# cement		Added at: ___ Batch Plant ___ Site	
12. Other: _____			(Specify Units)	
13. Water (including free water on aggregates)	_____ (lbs.)	_____ (cu. ft.)	_____ (gal.)	

C. Mix Design Characteristics: (Pozzolan = flyash and/or silica fume)
1. Water (including free water on aggregates)/(Cement + pozzolan): W / C = $\frac{\text{(lbs.)}}{\text{(lbs.)}}$ = ____ (Not applicable for LW concrete)
2. Fine Aggregate/Total Aggregate = $\frac{\text{(lbs.)}}{\text{(lbs.)}}$ = _____ 3. Pozzolan/Pozzolan+Cement) = $\frac{\text{(lbs.)}}{\text{(lbs.)}}$ = ____
4. Concrete Density: a. Unit Wet Weight _____ pcf b. Unit Dry Weight: _____ pcf
5. Air Content: _____%
6. Slump or Slump Flow a. Initial Slump (before adding WR or HRWR) _____ in.
   b. Final Slump or Flow (after adding WR or HRWR or SCC) _____ in.

D. Chloride Ion Content: The Concrete Supplier certifies that total chloride ion content of the concrete mix, as tested by ASTM C 1218 does not exceed the amounts specified in Table 4.4.1 of ACI 318.

E. Alkali Content: The Concrete Supplier certifies, if required by specification section 3300, that the total alkali content contributed from cementitious materials does not exceed 4.0 lbs./cu. yd. of concrete or certifies that the aggregate contains no deleterious material that react with alkalis in the concrete mix.

F. Mix Water Purity: The Concrete Supplier certifies that the appropriate specified chemical concentration limits are not exceeded in the total volume of mix water.

Notes:

1. This form is required to be submitted to Engineer and Design Professional's Testing Laboratory for all concrete mixes on the job. When any mix ingredient changes during the course of the job, this submittal form shall be resubmitted for approval. All information must be filled in for approval of mix design. Submit all backup data for calculations.
2. The mix designation should be that used by the Contractor to order the concrete from the Supplier and as noted on the batch ticket.
3. Refer to ACI 318 for requirements of each concrete mix design preparation method.
4. Submit sieve analysis of fine and course aggregates. Include chart indicating combined aggregate retained on each sieve size.

X. Certification by Concrete Supplier

Signature: _____ Representing: _____ Date: _____

SECTION 04 2100

MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Exterior, non-load bearing masonry veneer units and supplementary items necessary for installation.

1.2 DEFINITIONS

A. Masonry Veneer Terminology: Refer to BIA 2 and other referenced quality standards.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each type of product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

    a. Kind, size, and color of masonry unit.
    b. Manufactured accessory product.
    c. Cleaning products, including application procedures.

B. Shop Drawings: Show details of construction, including dimensioned drawings, plans, elevations, sections, and details of components to be incorporated into Work including, but not limited to, the following:

1. Masonry Veneer Units: Show sizes, profiles, and coursing.
2. Special Masonry Veneer Shapes: Submit large-scale details for each shape required or indicated.
3. Flashing: Large-scale details for each element of flashing system showing layout, profiles, methods of joining, and anchorage details; including lintel units, shelf units, corner units, end dam units, conditions showing interface and relationship to adjacent materials, and other special applications.
4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
5. Anchors, Ties, and Accessories: Show sizes, coursing, and locations.

C. Samples for Verification Purposes: Submit samples for each item listed below of size and construction indicated. Where products involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. Masonry Veneer: Full-size samples for each different unit indicated.
2. Pigmented and Color Aggregate Mortar: Make samples using same sand and mortar ingredients to be used on Project; label samples to indicate type and amount of pigments used.
3. Accessories: Samples of manufactured products, including anchors, ties, cavity drainage material, flashing materials, weeps, vents, and other accessories.

4. Flashing: Samples of each shape, profile, intersection and transition required, not less than 12 in (300 mm) long, including end dam, and splice/lap joint for lintel and shelf angle flashing; demonstrate soldering quality.

D. List of Materials Used in Constructing Wall Mock-ups:

1. Product, material, and equipment names, model numbers, lot numbers, batch numbers, source of supply, and other information required to identify items used. Include mix proportions for mortar and source of aggregates.
2. Receipt of list does not constitute acceptance approval of deviations from Contract Documents, unless such deviations are specifically accepted approved by Architect in writing.

E. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1. Masonry Veneer Units: Material test reports substantiating compliance with specified requirements.
2. Cementitious Materials: Each product required for mortar, including name of manufacturer, brand, type, and weight slips at time of delivery.
3. Mortar Mixes: Certification of mortar mix design shall be based on evaluation of comprehensive tests performed. Include description of type and proportions of ingredients.
4. Joint reinforcement: Each type and size of manufactured products.
5. Anchors, Ties, and Accessories: Each type and size of manufactured products.

F. Hot and Cold Weather Work Plan: Submit written plan detailing methods, materials and equipment to be used to comply with weather requirements.

G. Masonry Veneer Cleaning Plan: Based on technical information provided by respective manufacturer for each masonry veneer unit to be cleaned, submit written plan for cleaning exposed masonry veneer surfaces, prepared by commercial cleaning compound manufacturer, with signature of installer indicating acceptance and include following information:

1. Qualifications of applicators.
2. Products to be used and application procedures.
3. Masonry veneer surfaces to be cleaned and required preparations.
4. Environmental requirements by authorities having jurisdiction for use and discharge of cleaning effluents.
5. Protection of surrounding areas, landscaping, and building surfaces adjacent to area of cleaning.

H. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control" Article.

I. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.

J. Qualification Data: For manufacturer and installer.

1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
2. Architect may waive submittal of qualification data for available manufacturers listed in this Section.

1.4 QUALITY ASSURANCE

A. Quality Standards: In addition to specified requirements, comply with ACI 530.1/ASCE 6/TMS 602, and local building code, whichever is more stringent.

B. Manufacturer Qualifications: Manufacturer with not less than 10 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 10 years and with sufficient production capability, facilities, and personnel to produce required Work.

C. Installer Qualifications:

1. Experience: Installer with not less than 10 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 10 years, and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project during times specified Work is in progress that is experienced in installing systems similar to type and scope required for Project.

D. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with minimum of 5 years experience in providing recommendations, observations, evaluations, and problem diagnostics. Sales representatives are not acceptable.

E. Testing Agency Qualifications: An independent testing agency, qualified according to ASTM C 1093 to conduct the testing indicated.

F. Pre-Construction Mortar Testing: Design Professional will employ an independent testing agency to perform pre-construction testing to establish compliance of proposed Work with specified requirements.

1. General Requirements: Test mortar for composition to establish standard for field testing specified under "Field Quality Control" Article.
2. Test Method: ASTM C 780, Annex A4.
3. Specimen Quantity: Provide required number of mortar samples.
4. Reports: Interpret test results and prepare certified reports.
5. Equivalent Option to Testing: Testing will not be required if manufacturer's data is based on testing done within previous two years.
6. Retesting: Retesting of materials failing to meet specified requirements shall at Contractor's expense.

G. Sample Panels: Prior to installing masonry, build as many sample panels as required to verify selections made under submittals and to demonstrate aesthetic effects using specified materials:

1. Build approximately 48 in (1200 mm) square for each type of exposed masonry units.
2. Locate at locations indicated or, if not indicated, as directed by Architect.
3. Clean exposed faces with masonry cleaner specified.
4. Where masonry is to match existing masonry, erect panels adjacent and parallel to an existing, south-facing wall.
5. Notify Architect 7 days in advance of the dates and times when panels will be constructed.
6. Protect accepted approved sample panels with weather-resistant membrane.
7. Maintain during construction in an undisturbed condition as a standard for judging completed Work.

8. Acceptance Approval of panels is for following aesthetic qualities; acceptance approval does not constitute acceptance approval of deviations from Contract Documents, unless specifically accepted approved by Architect in writing:

    a. Color, texture, and blending of masonry units.
    b. Color and blending of mortar.
    c. Relationship of mortar and sealant colors to masonry unit colors.
    d. Tooling of joints.
    e. Effectiveness of masonry cleaner.
    f. Other aesthetic qualities as determined by the Architect.

9. When directed, demolish and remove mock-up from Project site, including foundations.

H. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

    a. Show typical components, attachments to building structure, and requirements of installation.

2. Clean exposed faces of mock-up.
3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Protect accepted approved mock-up from the elements with weather-resistant membrane.
6. Obtain Architect's acceptance approval of mock-ups before starting fabrication.
7. Maintain mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.
8. Acceptance Approval of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and accepted approved by Architect in writing.
9. Demolish and remove mock-ups when directed by Architect unless accepted approved to become part of the completed Work.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

    a. Owner.
    b. Architect.
    c. Contractor, including superintendent.
    d. Installer, including project manager and supervisor.
    e. Manufacturer's technical representative.
    f. Installers of other construction interfaced with Work.
    g. Testing agency.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, the following topics:

   a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
   b. Review Work requirements (Drawings, Specifications, and other Contract Documents).
   c. Review required submittals, both completed and yet to be completed.
   d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   e. Review required inspection, testing, certifying, and material usage accounting procedures.
   f. Review environmental conditions and procedures for coping with unfavorable conditions.
   g. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Label pallets of masonry veneer units with manufacturers name, product name, and information required to identify products.

B. Storage:

1. Masonry Veneer Units: Store on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
2. Cementitious Materials: Store on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
3. Aggregates: Store where grading and other required characteristics can be maintained and contamination avoided.
4. Accessories: Store to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Protection during Work: Prevent excess moisture from entering Work in progress.

1. Cover tops of walls, projections, and sills with water-repellent tarps or heavy plastic sheets at end of each day's Work.
2. Cover partially completed masonry veneer when construction is not in progress.
3. Extend cover minimum of 24 in (600 mm) down both sides and hold cover securely in place.
4. Protect door and window frames from damage.

B. Stain Prevention: Prevent mortar and soil from staining exposed masonry veneer. Immediately remove mortar and soil from exposed masonry veneer.

1. Protect base of walls from rain-splashed mud and mortar splatter.
2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, and other adjacent with painted and integral finishes from mortar droppings.
4. Turn scaffolding planks near Work on edge at end of each day to prevent rain from splashing mortar droppings or dirt onto face of exposed masonry veneer.

C. Cold Weather Requirements: Comply with building code or TMS 602/ACI 530.1/ASCE 6 whichever is more stringent, and the following:

1. Do not apply when ambient temperature is less than 32 deg F (0 deg C) or when 40 deg F (4.4 deg C) or less and falling.
2. Provide heat and protection (temporary or permanent) as required to protect Work from freezing for not less than 48 hours after application.
3. Distribute heat uniformly to prevent concentration of heat near sources; provide deflection or protective screens.
4. Do not use frozen materials or materials mixed or coated with ice or frost.
5. Do not build on frozen substrates.
6. Remove and replace masonry veneer damaged by frost or freezing conditions.
7. Use liquid cleaning methods only when air temperature is 40 deg F (4.4 deg C) and above and will remain so until masonry veneer has dried, but not less than 7 days after completing cleaning.

D. Warm Weather Requirements: Comply with building code or TMS 602/ACI 530.1/ASCE 6 whichever is more stringent, and the following:

1. Protect Work against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial.
2. Apply and cure work as required by climatic and job conditions to prevent dryout during cure period.
3. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Available Manufacturers and Products: Manufacturers offering products that may be incorporated into the Work include those listed.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Masonry Units: Obtain exposed masonry veneer units of a uniform texture and color, or a uniform blend within ranges accepted for these characteristics.

C. Cementitious Materials: Obtain cementitious ingredients of a uniform quality, including color, for each component.

2.3 MASONRY UNITS, GENERAL

A. Defective Units: Referenced standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in standard. Do not install units where defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in completed Work or will impair quality of completed masonry veneer.

B. Special Shapes: Provide shapes indicated and as follows for each form of masonry unit required:

1. For applications requiring units of form, color, texture, and size on exposed surfaces that cannot be produced by sawing standard unit sizes.
2. For applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
3. For applications where stretcher units cannot accommodate special conditions including those at corners, movement joints, bond beams, sashes, and lintels.
4. For units without cores or frogs and with exposed surfaces finished for ends of sills, caps, and similar applications that would otherwise expose unfinished unit surfaces.

C. Match Existing Masonry Veneer: Wherever "match existing" indicated, provide masonry veneer unit of matching color, texture, and size as existing adjacent masonry veneer work.

2.4 FACE BRICK MASONRY UNITS

A. Product Quality Standard: ASTM C 216 or ASTM C 652, Grade SW, Type FBS.

1. Unit Compressive Strength: Minimum 3000 psi (20.7 MPa) for average of 5 bricks, and 2500 psi (17.2 MPa) for individual brick, gross area, according to ASTM C 67, Section 7.
2. Hot and Cold Water Testing:

a. Water Absorption: Maximum 17.0 percent for average of 5 bricks, and 20.0 percent for individual brick, according to ASTM C 67, Section 8 for 5 hour boiling test.
b. Saturation Coefficient: Maximum 0.78 for average of 5 brick, and 0.80 for individual brick.
c. Requirement Waivers:

1) Absorption: Saturation coefficient requirement may be waived if there is maximum 8.0 percent absorption of random sampling of 5 bricks according to ASTM C 67, Section 8 for 24 hour submersion test.
2) Freezing and Thawing: Water absorption and saturation coefficient requirements may both be waived if there is maximum 0.5 percent loss in dry weight of any individual brick according to ASTM C 67, Section 9, for 50 cycles of freezing and thawing.

3. Initial Rate of Absorption: Between 5 and 25 g/m per 30 sq in (0.02 sq m) according to ASTM C 67, Section 10. Use of coating to establish initial rate of absorption is not permitted and will not be allowed.
4. Efflorescence: Rated "not effloresced" according to ASTM C 67, Section 11.
5. Surface Coloring: Brick with surface coloring, other than flashed or sand-finished brick, shall withstand 50 cycles of freezing and thawing according to ASTM C 67, Section 8, with no observable difference in applied finish when viewed from 10 ft (3 m) under an minimum illumination of 50 foot-candles (538 lumen/square meter).

B. Basis of Design:

1. Manufacturer: Cherokee Brick and Tile Co.
2. Color Name and Number: Providence.
3. Size (Actual Dimensions)

a. Unit Designation: Utility.
b. Width: 3-1/2 in to 3-5/8 in (89 mm to 92 mm).
c. Height: 3-5/8 in (92 mm).
d. Length: 7-5/8 in (194 mm).
e. Vertical Coursing: 2 within 8 in (200 mm).

2.5 NATURAL STONE MASONRY UNITS

A. Basis of Design:

1. Manufacturer / Quarry: Tennessee Fieldstone.
2. Size Range (Nominal Dimensions):

a. Minimum:

1) Width: 4 in (100 mm).
2) Height: 4 in (100 mm).
3) Length: 12 in (300 mm).

b. Maximum:

1) Width: 4 in (1002 mm).
2) Height: 8 in (200 mm).
3) Length: 24 in (600 mm).

2.6 SHELF ANGLES AND LINTELS

A. Steel Angle Lintels: Materials complying with Division 05 Section "Metal Fabrications" for loose masonry lintels (Designation MF), with schedule as shown on the Drawings.

B. Masonry Lintels: Prefabricated or built-in-place masonry lintels as shown of the Drawings made from masonry units with reinforcing bars placed as indicated and filled with coarse grout. Cure prefabricated lintels before handling and installing.

2.7 MORTAR MATERIALS

A. Portland Cement:

1. Material Quality Standard: ASTM C 150, Type I; except Type III may be used for cold-weather construction.
2. Color: Natural gray color or white cement as required to produce mortar color required.
3. Manufacturers:

a. Lafarge North America.
b. Lehigh Cement Co.
c. Lone Star Industries, Inc.
d. Rinker Materials.
e. Royal White Cement.

B. Hydrated Lime:

1. Material Quality Standard: ASTM C 207, Type S.
2. Manufacturers:

    a. Cheney Lime & Cement Co.
    b. Graymont Dolime (OH) Inc.
    c. Rockwell Lime Co.

C. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.

1. Types of Cements Not permitted:

    a. Masonry Cement: ASTM C 91.
    b. Mortar Cement: ASTM C 1329.

D. Aggregate for Standard Gray Mortar:

1. Product Quality Standard: ASTM C 144.
2. Mortar Exposed to View: Use washed aggregate consisting of natural sand or crushed stone.
3. Joints Less Than 1/4 in (6 mm) Thick: Use aggregate graded with 100 percent passing No. 16 sieve.

E. Aggregate for White Mortar: Natural white sand or ground white stone, as required to match approved sample.

F. Aggregate for Colored Mortar: Natural sand or ground marble, granite, or other sound stone, as required to match approved sample.

G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Quantity Limitations: Pigments shall not exceed 10 percent of Portland cement by weight for mineral oxides or 2 percent for carbon black.
2. Manufacturers and Products:

    a. Bayer Corp., Industrial Chemicals Div.; Bayferrox Iron Oxide Pigments.
    b. Davis Colors; True Tone Mortar Colors.
    c. Solomon Grind-Chem Service, Inc.; SGS Mortar Colors.

H. Colored Portland Cement-Lime Mix: Packaged blend made from Portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Quantity Limitations: Pigments shall not exceed 10 percent of Portland cement by weight or 2 percent for carbon black.
2. Manufacturers and Products:

    a. Capital Materials Corp.; Riverton Portland Cement Lime Custom Color.
    b. Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
    c. Lafarge North America Inc.; Eaglebond.
    d. Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.

I. Water: Potable, clean and free of amounts of oils, acids, alkalies, salts, organic materials, or other substances that are deleterious to mortar or any metal within the wall.

2.8 REINFORCEMENT

A. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

B. Masonry Joint Reinforcement for Multi-wythe Masonry: As specified in Division 04 Section "Structural Reinforced Concrete Unit Masonry".

2.9 VENEER ANCHORS AND TIES

A. General: For attaching masonry veneer to a back-up structure, use two-piece assemblies that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall; suitable for attachment conditions indicated.

1. Corrugated ties are not permitted.

B. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 in (1.3 mm).

C. Materials for Adjustable Masonry Veneer Anchors: Use one of the following. Mill-galvanized ties are not permitted.

1. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82 / A 82M with ASTM A 153 / A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008 / A 1008M, commercial sheet, hot-dip galvanized after fabrication to comply with ASTM A 153 / A 153M, Class B coating.
3. Stainless-Steel Bars and Shapes for Stone Trim: ASTM A 276 or ASTM A 666, Type 304.

D. Adjustable Anchors for Connecting to Concrete, CMU or Structural Steel:

1. Description: Two-piece adjustable veneer anchoring system.

a. Anchors: Zinc alloy barrel, flanged head, screw and eye, with drilling threads suitable for structural substrate.
b. Ties: Hot-dip galvanized, carbon-steel wire, 3/16 in (5 mm) pre-coated diameter, triangular shaped ties, size as required to provide maximum bond, not less than 2 in (50 mm).

2. Basis of Design: Heckmann Building Products, Inc.; "POS-I-TIE Masonry Veneer Anchor System".

E. Adjustable Masonry Veneer Anchors for Sheathed Steel Studs Walls:

1. Anchor Plate: Minimum 0.0713 in (14 gage) (1.81 mm) uncoated base metal thickness, with raised strap stamped vertically into center to provide a slot between strap and plate for interlocking wire tie, with one screw hole at top and one at bottom; with rubberized asphalt flexible flashing material either adhered to back of plate, or loose for separate mounting.
2. Wire Tie: Minimum 3/16 in (5 mm) diameter, bent into triangle shaped tie; length as required to extend at least halfway through masonry veneer but with minimum 5/8 in (15 mm) cover on outside face of masonry veneer.
3. Manufacturers and Products:

a. Dayton Superior Corp.; Dur-O-Wal Division; "DA 210" anchor plate with "Tri-Tie"

b. Heckmann Building Products, Inc.; "315D" anchor plate with "316" wire tie.
c. Hohmann & Barnard, Inc.; "DW-10HS" anchor plate with "Vee Tie".
d. Wire-Bond; "Type III Anchor" with triangular wire tie.

F. Adjustable Masonry Veneer Anchors for Sheathed Steel Studs Walls with Rigid Insulation in Cavity:

1. Anchor Plate: Minimum 0.0713 in (14 gage) (1.81 mm) uncoated base metal thickness, with projecting horizontal tabs of length to allow for insulation thickness, with holes or slots to receive pintel legs, with two screw holes; with rubberized asphalt flexible flashing material either adhered to back of plate, or loose for separate mounting.
2. Wire Pintel: Minimum 3/16 in (5 mm) diameter, bent into open-end rectangle box shaped tie with 2 legs bent down to slip into anchor slot; length as required to extend at least halfway through masonry veneer but with minimum 5/8 in (15 mm) cover on outside face of masonry veneer.
3. Manufacturers and Products:

a. Dayton Superior Corp.; Dur-O-Wal Division; "DA 213" anchor plate with "DA 213" wire pintel.
b. Hohmann & Barnard, Inc.; "HB-200" anchor plate and wire pintel.
c. Wire-Bond; "RJ-711" ("2401" anchor plate and "2402" wire pintel).

G. Polymer-Coated Steel Drill Screws for Steel Studs:

1. Material Quality Standard: ASTM C 954.
2. Description: Self-drilling, hex washer head with bonded EPDM washer, screw of size and length required to penetrate steel stud flange by not less than 3 exposed threads; corrosion protective organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.

2.10 MISCELLANEOUS ANCHORS

A. Dovetail Slots in Concrete for Shelf Angles: As specified in Division 03 Section "Concrete Accessories" unless indicated otherwise.

2.11 EMBEDDED FLASHING MATERIALS

A. Sheet Metal Flashing: Metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Material:

a. Quality Standard: ASTM A 240 / A 240M or A 666, Type 304.
b. Description: Stainless steel, 2D annealed finish, not less than 0.0250 in (24 ga) (0.64 mm) thick, unless noted otherwise.

2. Solder:

a. Material Quality Standard: ASTM B 32, Grade Sn60.
b. Description: Solder with acid flux of type recommended by stainless steel sheet manufacturer; use a noncorrosive rosin flux over tinned surfaces.

B. Sealant for Sheet Metal Flashing: Exterior non-sag silicone sealant, Class 150/50, as specified in Division 07 Section "Joint Sealants".

C. High-Temperature Rubberized Asphalt Flashing:

1. Description: Minimum 40 mils (1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).
4. Manufacturers and Products:

    a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
    b. Henry Company; Blueskin PE200 HT.
    c. Metal-Fab Manufacturing, LLC; MetShield.
    d. Owens Corning; WeatherLock Metal High Temperature Underlayment.

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.12 ACCESSORIES

A. Weeps and Vents: Provide the following:

1. Plastic Weep and Vent:

    a. Description: One-piece flexible extrusion made from ultraviolet light resistant polypropylene copolymer, consisting of honeycomb matrix of multiple cells, designed to fill head joint with outside face held back 1/8 in (3 mm) from exterior face of masonry veneer.
    b. Color: As selected by Architect from manufacturer's standard colors available.
    c. Manufacturers and Products:

        1) Advanced Building Products, Inc.; Mortar Maze Weep Vents.
        2) Dayton Superior Corp.; Dur-O-Wal Division; Cell Vent, D/A 1006.
        3) Heckmann Building Products, Inc.; No. 85 Cell Vent.
        4) Hohmann & Barnard, Inc.; QV - Quadro-Vent.
        5) Wire-Bond; Cell Vent

B. Cavity Drainage Material:

1. Description: Composed of either reticulated, nonabsorbent mesh made from polyethylene strands, or, polymer core geomatrix composed of woven nylon strands, molded and shaped in open weave configuration to maintain drainage at weeps without being clogged by mortar droppings, size as required to extend across entire width of cavity.
2. Manufacturers and Products:

    a. Advanced Building Products, Inc.; Mortar Break II.
    b. Heckmann Building Products, Inc.; No. 84 Weep-Thru Mortar Deflector.
    c. Mortar Net USA, Ltd.; Mortar Net.
    d. Polyguard Products, Inc.; Termi-Net.
    e. Wire-Bond; Cavity Net II.

C. Bond Breaker Strips:

1. Material Quality Standard: ASTM D 226, Type I.
2. Description: Asphalt-saturated organic roofing felt (No. 15 asphalt felt).

D. Termination Bars:

1. Material Quality Standard: ASTM A 666, Type 304.
2. Description: 1/8 in (3 mm) thick by 1 in (25 mm) wide continuous stainless steel bar with 1/4 in (6 mm) diameter holes spaced at 8 in (200 mm) on centers.
3. Anchors: Same type screws as used to attach veneer wall ties.
4. Manufacturers and Products:

a. Advanced Building Products, Inc.; Termination Bar.
b. Hohmann & Barnard, Inc.; T1 or T2, as indicated on the Drawings.
c. Tru-Fast Corp.; TB-75.

E. Cavity Wall Insulation: As specified in Division 07 Section "Thermal Insulation".

2.13 MASONRY VENEER CLEANERS

A. Commercial Cleaning Compounds: Products as recommended and approved by masonry veneer and mortar manufacturers.

1. Description: Manufacturer formulated, general purpose cleaner for removing mortar stains, efflorescence, and other construction related stains from new masonry veneer surfaces, with following suitability requirements:

a. Suitable for masonry veneer units and mortar installed, without discoloring or damaging masonry veneer materials.
b. Suitable for conditions at project site, including, but not limited to, windows, doors, other exterior wall elements, and adjacent walks or landscaping.

2. Manufacturers:

a. Diedrich Technologies, Inc.
b. EaCoChem.
c. Prosoco, Inc.

B. Cleaning Restrictions: Following methods are not permitted nor will they be allowed:

1. Hydrochloric acid.
2. Muratic acid.
3. Pressurized water blasting.
4. Abrasive blasting.

2.14 METAL FLASHING FABRICATION

A. Field Measurements: Where metal flashing is to fit, cope, or be tailored to other construction, check actual dimensions of other construction by accurate field measurements before fabrication of metal flashing.

B. Fabrication Procedures: Fabricate continuous flashings in sections 8 ft (2.4 m) long minimum, but not exceeding 12 ft (3.6 m). Provide splice plates at joints of formed, smooth metal flashing.

1. Shop form flashing on a bending brake.
2. Shape, trim and hand seam on bench as far as practical with proper tools.

3. Form exposed metal Work without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated.
4. Make angle bends and folds for interlocking metal with full regard for expansion and contraction to avoid buckling or fullness in metal after installation.
5. Form materials to shape indicated with straight lines, sharp angles and smooth curves.
6. Fold and hem exposed edges of flashings.

C. Flashing Joinery: Fabricate interior and exterior corners, intersections, and complex flashing conditions in shop, rather than in field, with properly folded, constructed and continuous soldered joints. Field fabricated units are not permitted and will not be allowed.

2.15 MORTAR MIX

A. General: Mix cementitious materials in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency for minimum 3 minutes to 5 minutes; do not hand mix.

1. Admixture Limitation: Do not use admixtures including air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, calcium chloride or other admixtures.
2. Cementitious Limitation: Limit cementitious materials in mortar to Portland cement and lime.
3. Ingredient Measurement: Measure in a one cubic foot batching box before mixing for component materials not pre-blended, prepackaged or containerized.
4. Aggregate Moisture Content: Monitor moisture content of aggregates and exercise caution when mixing to avoid over or understanding of mortar.

B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project.

C. Mortar Mix:

1. Mix Quality Standard: ASTM C 270, Proportion Specification for Portland cement-lime mortars, Type N.
2. Match Existing Mortar: Wherever "match existing" indicated, provide masonry mortar of matching color and texture as existing adjacent masonry veneer work.
3. Basis of Design: Use with MV-01.

a. Manufacturer: Lehigh Cement Co.
b. Color Name and Number: Buff; CM12101.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Applicable portions of BIA "Technical Notes on Brick Construction", if no other installation quality standard applies to condition.
2. ACI 530.1/ASCE 6/TMS 602 and local building code.
3. Respective manufacturer's written installation instructions.
4. Accepted submittals.
5. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF MASONRY VENEER

A. Installation Performance Requirements: Ensure masonry cavity is properly isolated from building interior to prevent water infiltration from infiltrating out of masonry cavity into other components of building such as window and door jambs and building interiors.

B. Openings: Leave for equipment to be installed before completion of masonry veneer; after installation of equipment, complete masonry veneer to match construction immediately adjacent to opening.

C. Cutting: Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, un-chipped edges. Install cut units with cut surfaces and, where possible, cut edges concealed.

D. Blending of Masonry Veneer Units: Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed. If color blending is a critical aspect of Work, manufacturer shall provide instructions for blending.

E. Mortar Workability: Maintain by remixing or retempering; mortar with added color pigments shall not be re-tempered. Discard mortar that has begun to stiffen or is not used within 2.5 hours after initial mixing.

F. Match Existing Masonry Veneer: Match coursing and bonding of existing masonry veneer.

3.5 SHELF ANGLES AND LINTELS

A. Steel Shelf Angles: Erection as specified in Division 05 Section "Metal Fabrications".

B. Steel Loose Lintels: Set where indicated or required, with not less than 8 in (200 mm) of bearing at each jamb, unless otherwise indicated.

3.6 LAYING MASONRY VENEER WALLS

A. General: Lay out walls in advance for accurate spacing of surface bond patterns, uniform joint thicknesses, accurate location of openings, movement-type joints, returns, and offsets. Avoid using of less than half-size units at corners, jambs, and where possible at other locations.

B. Bond Patterns:

1. Exposed Masonry Veneer: Match coursing of existing masonry, unless otherwise indicated.
2. Concealed Masonry Veneer: Lay units in a wythe in running bond or bonded by lapping not less than 2 in (50 mm) lap.
3. Corners: Bond and interlock each course of each wythe. Do not use units with less than nominal 4 in (100 mm) horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: In each course, rack back one-half unit length for one-half running bond pattern or one-third unit for one-third running bond pattern; do not tooth. When resuming Work, clean masonry veneer surfaces that are to receive mortar, remove loose masonry veneer units and mortar.

D. Built-In Work:

1. As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry veneer around built-in items.
2. Fill space between steel frames and masonry veneer solidly with mortar, unless otherwise indicated.

3.7 MORTAR BEDDING AND JOINTING

A. General Procedures:

1. Do not disturb previously laid units.
2. Spread mortar for bed joint only so far ahead of laying units that mortar will be plastic when units are laid.
3. Butter end of unit with ample mortar so that head joint is completely filled with mortar when placed.
4. Do not deeply furrow bed joints or slush head joints.
5. Avoid over-plumbing and pounding of corners and jambs to fit stretcher unit after setting in place. Where adjustments must be made after initial setting, remove mortar and replace with fresh mortar.
6. Rock closures into place with both head joints and closure space spread with ample mortar. Place against adjacent units so that both horizontal and vertical joints are completely filled.

B. Mortar Joint Thickness: Minimum 3/8 in (10 mm) wide for head and bed joints.

C. Hollow Masonry Veneer Units: Lay with face shells fully bedded in mortar and with head joints of depth equal to bed joints; with entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

D. Solid Masonry Veneer Units: Lay with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and place into wall construction. Do not deeply furrow bed joints or slush head joints.

E. Joint Tooling: Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

1. Make mortar joints straight, clean, and uniform in thickness. Tool joints to produce dense surface well bonded to edges.
2. Joints which are not tight at time of tooling shall be raked out, pointed, and then tooled.
3. Tool when mortar is partially set but still sufficiently plastic to bond.
4. Use a tool which compacts mortar, pressing excess mortar out of joint rather than dragging it out.

5. Tool vertical joint first.

3.8 MASONRY CAVITIES, WEEPS, AND VENTS

A. Cavity Cleaning: Keep cavity clean of mortar droppings and other materials. Strike joints facing cavity flush.

B. Mortar Protection: Install cavity drainage material at base of cavity to protect bottom of cavity from mortar droppings that would prevent weeps from draining infiltrated water.

C. Cavity Wall Insulation: As specified in Division 07 Section "Thermal Insulation". In addition, install continuous strip of rigid cavity insulation, minimum 3 in (75 mm) wide, at edges of cavities adjacent to jamb of through-wall openings.

D. Weeps: Install weeps at maximum 24 in (600 mm) on centers in head joints of first course of masonry veneer immediately above embedded flashings.

E. Vents: Install vents at maximum 24 in (600 mm) on centers in head joints of topmost course of masonry veneer immediately below shelf angles, and at top of each continuous cavity.

3.9 ANCHORING MASONRY VENEER

A. Adjustable Anchors for Connecting to Concrete, CMU or Structural Steel: Anchor masonry veneer to structural members where masonry veneer abuts or faces structural members to comply with following, with anchors embedded in masonry veneer joints and attached to structure:

1. Unless otherwise indicated, provide an open space not less than 1 in (25 mm) in width between back of masonry veneer and structural member. Keep open space free of mortar or other rigid materials.
2. Anchor masonry veneer to structural members with anchors embedded in masonry joints and attached to structure.
3. Space anchors vertically and horizontally as required for coursing with one anchor for every 2 sq ft (1858 sq cm) of masonry veneer; stagger alternating anchors in each row.

B. Adjustable Masonry Veneer Anchors for Sheathed Steel Studs Walls: Anchor masonry veneer to sheathed steel studs with proper anchors.

1. Unless otherwise indicated, provide an open space not less than 2 in (50 mm) in width between back of masonry veneer and face of sheathing.
2. Keep open space free of mortar or other rigid materials.
3. Locate anchor plate portion of wall tie to allow maximum vertical differential movement of tie up and down.
4. Space anchors at 16 in (400 mm) on center vertically and 16 in (400 mm) on center horizontally as required for coursing.
5. Install additional anchors within 12 in (300 mm) of openings and at maximum 8 in (200 mm) on center around perimeter.
6. Attach each anchor through sheathing to steel studs with 2 metal fasteners each. Install rubberized asphalt flashing strips under each anchor.
7. Embed wall tie, in proper orientation, at least halfway through masonry veneer but with at least 5/8 in (15 mm) cover on outside face of masonry veneer.

3.10 EMBEDDED FLASHINGS

A. General: Drawings may not necessarily indicate or describe full extent of Work required for completion of embedded flashing.

B. Reglets and Nailers: Install for flashing and other related construction where they are shown to be built into masonry.

C. Scheduled Locations: In addition to conditions shown on Drawings, install embedded flashings within masonry cavity at following locations to direct downward flow of infiltrated water within cavity to exterior:

1. Shelf angles with end dams at through-wall openings; and with lap joints.
2. Lintels with end dams or laps.
3. Jambs at through-wall openings, full height from sill to head.
4. Other obstructions.

D. Preparation: Substrate surfaces shall be smooth and free from projections that could puncture flashing.

E. Flashing Installation:

1. Install sheet metal flashing true to line and levels indicated; minimize quantity of lap joints by using longest units possible.
2. Set shaped sheet metal units in proper locations with outside hemmed edges flush with building face location indicated; attach cavity side flanges to sheathed steel stud wall with screw fasteners driven into studs.
3. At continuous shelf angles, terminate horizontal flashings at through-wall openings with properly folded and constructed sheet metal end dams with a depth equivalent to one masonry veneer course, with continuous soldered joints.
4. At lintels, terminate horizontal flashings at end of lintel with properly folded and constructed sheet metal end dams with a depth equivalent to one masonry veneer course, with continuous soldered joints.
5. At lap joints of horizontal flashings, form neat and aligned joints by interlocking splice plate within hemmed edge of sheet metal flashing profile; apply sealant and rubberized asphalt flashing as indicated to create water-resistant joint.
6. Set shaped sheet metal units at jambs of through-wall openings and lap inside of end dams at horizontal flashings below; coordinate installation with rigid cavity insulation.
7. Seal cavity edges of sheet metal flashings within masonry cavity to sheathing with continuous rubberized asphalt flashing.

F. Examination and Repair: Immediately prior to laying masonry veneer, examine exposed surfaces of flashing and seal penetrations and damaged areas with rubberized asphalt flashing material before covering with masonry veneer.

3.11 MASONRY VENEER EXPANSION JOINTS

A. General: Install masonry veneer expansion joints materials as Work progresses. Do not allow materials to span masonry veneer expansion joints without provision to allow for in-plane wall or partition movement. Maintain joints free and clear of mortar.

B. Vertical Expansion Joints:

1. Locate where indicated but not to exceed 26 ft (8 m) on center, and within 10 ft (3 m), 4 ft (1.22 m) preferred, of each side of outside corner. Keep vertical joints straight, true, and continuous from top to bottom of masonry veneer.
2. Form open joint of width indicated for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants".

C. Horizontal Joints: Build in horizontal pressure-relieving joints where indicated; construct of width required for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants".

Locate not less than 3/8 in (9 mm) wide horizontal pressure-relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

3.12 INSTALLATION TOLERANCES

A. Conspicuous Lines:

1. Vertical: For such conditions as external corners, door and window jambs, reveals, and masonry veneer expansion joints, maximum variation of the following from plumb:

   a. 1/8 in (3 mm) in 10 ft (3 m).
   b. 1/4 in (6 mm) in 20 ft (6 m).
   c. 1/2 in (12 mm) overall.

2. Horizontal: For such conditions as exposed lintels, sills, door and window heads, parapets, and reveals, maximum variation of the following from level:

   a. 1/8 in (3 mm) in 10 ft (3 m).
   b. 1/4 in (6 mm) in 20 ft (6 m).
   c. 1/2 in (12 mm) overall.

B. Exposed Head Joints:

1. Vertical Alignment: Maximum variation of the following from plumb:

   a. 1/4 in (6 mm) in 10 ft (3 m).
   b. 1/2 in (12 mm) from plumb top to bottom of wall.

2. Thickness: Maximum variation from width indicated of plus or minus 1/8 in (3 mm); maximum variation from adjacent bed joint and head joint thicknesses 1/8 in (3 mm).

C. Exposed Bed Joints: Maximum variation from width indicated of plus or minus 1/8 in (3 mm), with a maximum thickness limited to 1/2 in (12 mm); maximum variation from bed joint thickness of adjacent courses of 1/8 in (3 mm).

D. Flush Alignment: Maximum variation of 1/16 in (1.5 mm) except due to warpage of masonry veneer units with tolerances specified for warpage of units.

3.13 FIELD QUALITY CONTROL

A. Manufacturer's Field Service - Masonry Veneer Cleaning Product: Manufacturer's qualified technical representative shall inspect first day's Work and periodically inspect Work to ensure cleaning process is proceeding in accordance with Manufacturer's recommendations and instructions. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

B. Testing and Inspection of In-Progress Work: Design Professional will employ a qualified independent testing agency to perform following testing of in-progress Work. Retesting of materials failing to meet specified requirements shall be at Contractor's expense.

1. Testing: Testing agency will test and evaluate Work during construction.
2. Mortar Tests: Verify mortar composition with specified requirements according to ASTM C 780, Annex A4; made at following times during Work:

   a. First day.

b. 5 percent.
c. 15 percent.
d. 30 percent.
e. 60 percent.

3. Inspections: Testing agency will visit project site periodically at random, but not less than once during each week of masonry veneer Work, to inspect progress and to ascertain if Work complies with Contract Documents. Allow inspectors access to scaffolding and Work areas, as needed to perform inspections. Inspections will include verification that:

   a. Materials are properly stored.
   b. Installation is within specified construction tolerances.
   c. Proper mortar ingredients and mixing techniques are being used.
   d. Mortar time on board is within specified limits.
   e. Bed and head joints are being properly made.
   f. Masonry cavity is being kept clean.
   g. Ties and anchorages are as specified.
   h. Joints are being properly tooled.
   i. Flashing assembly is being properly fabricated and installed.
   j. Weeps and vents are being installed and are functional.
   k. Masonry veneer expansion joints are being installed as indicated or as specified.

4. Evaluation of Quality Control Tests: Replace Work in areas where test results fail to comply with requirements indicated.

3.14 ADJUSTING

A. Repairs for Damage: Remove and replace masonry veneer units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units and install fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During tooling of joints, enlarge any voids or holes, except weeps and vents, and completely fill with mortar. Point up all joints including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for application of sealants, where indicated.

3.15 CLEANING

A. In-Progress Cleaning: As soon as practical, clean masonry veneer as Work progresses by dry brushing to remove mortar fins and smears prior to tooling joints.

B. Protection: Prior to Final Cleaning, protect surrounding areas, landscaping, adjacent surfaces, and vehicles from contact with cleaning products.

C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry veneer as follows:

1. Protect adjacent and nearby materials, especially windows and glass, to avoid damage.
2. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
3. Test cleaning methods on mock-ups; leave one half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of permanent masonry veneer.
4. Clean masonry veneer by means recommended by cleaning product manufacturer using masonry cleaner compound as recommended and approved by masonry veneer and mortar manufacturers.
5. Avoid drifting of cleaning spray caused by wind.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 04 2213

STRUCTURAL REINFORCED CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 CODES AND STANDARDS

A. All concrete masonry construction shall conform to the requirements of the local building code and the following codes:

1. "Building Code Requirements for Masonry Structures", ACI 530/ASCE 5/TMS 402, The Masonry Standards Joint Committee.

2. Specification for Concrete Masonry Structures, ACI 530.1/ASCE 6/TMS 602

3. International Building Code, Chapter 21

Where a conflict occurs between the codes, the International Building Code shall apply.

B. The Following Standards are listed in this Specification

ASTM A 82	"Specification for Steel Wire, Plain, for Concrete Reinforcement"
ASTM A 153	"Specification for Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products"
ASTM A 307	"Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength"
ASTM A 615	"Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement"
ASTM A 653	"Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process"
ASTM A 767	"Specification for Zinc-Coated (Galvanized) Bars for Concrete Reinforcement"
ASTM A 775	"Specification for Epoxy-Coated Reinforcing Steel Bars"
ASTM A 951	"Specification for Steel Wire for Masonry Joint Reinforcement"
ASTM A 1008	"Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable"
ASTM C 90	"Specification for Load-Bearing Concrete Masonry Units"
ASTM C 140	"Test Methods for Sampling and Testing Concrete Masonry Units"
ASTM C 144	"Specification for Aggregate for Masonry Mortar"
ASTM C 150	"Specification for Portland Cement"
ASTM C 207	"Specification for Hydrate Lime for Masonry Purposes"
ASTM C 270	"Specification for Mortar for Unit Masonry"
ASTM C 404	"Specification for Aggregate for Masonry Grout"
ASTM C 476	"Specification for Grout for Masonry"

ASTM C 516	"Specification for Vermiculite Loose Fill Thermal Insulation"
ASTM C 549	"Specification for Perlite Loose Fill Insulation"
ASTM C 578	"Specification for Rigid, Cellular Polystyrene Thermal Insulation"
ASTM C 744	"Specification for Prefaced Concrete and Calcium Silicate Masonry Units"
ASTM C 954	"Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in (2.84 mm) in Thickness"
ASTM C 1314	"Test Method for Compressive Strength of Masonry Prisms"
ASTM C 1329	"Standard Specification for Mortar Cement"
ASTM D 226	"Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing"
ASTM D 1056	"Specification for Flexible Cellular Materials- Sponge or Expanded Rubber"
ASTM D 2287	"Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds"
ASTM E 119	"Test Methods for Fire Tests of Building Construction and Materials"
ASTM E 329	Specification for Agencies Engaged in the Testing and/or Inspection of Materials used in Construction

1.3 DESCRIPTION OF WORK

A. Extent of each type of reinforced unit masonry work is indicated on the architectural and structural drawings and in schedules. Provide all labor, materials, equipment, and services necessary for and incidental to the installation of all reinforced masonry construction as indicated on the drawings and specified herein.

B. Reinforced unit masonry construction includes reinforced concrete masonry including concrete filled masonry beams, columns, pilasters, lintels, and soffits. Accessories include, but are not necessarily limited to ties, horizontal and vertical reinforcement, anchors to the structure, and control joints.

C. The masonry contractor shall install all accessory items that are required in the work and supplied by others, including: bolts, nailing blocks, inserts, anchors, flashing, steel lintels, expansion joints, conduits, cast-stone trim, hollow-metal door frames, etc.

D. Types of masonry work required include Concrete unit masonry (CMU).

1.4 QUALITY ASSURANCE

A. Fire Performance Characteristics: Where indicated, provide materials and construction which are identical to those of assemblies whose fire endurance has been determined by testing in compliance with ASTM E 119 by a recognized testing and inspecting organization or by another means, as acceptable to the **Design Professional.**

B. Single Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

C. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

D. Masonry Preconstruction Testing Service: Employ and pay for the services of an independent testing laboratory acceptable to **Design Professional** and experienced in performing types of preconstruction masonry tests indicated. The testing laboratory shall meet the basic requirements of ASTM E 329 and have current accreditation from either the American Association for Laboratory Accreditation, the AASHTO Accreditation Program, or the "NIST" National Voluntary Laboratory Accreditation Program..

1. Preconstruction Verification by Unit Strength Method

   a. Concrete Masonry Units: For each type of concrete masonry wall construction shown on the structural or architectural drawings, submit results of tests conducted in accordance with ASTM C140 that demonstrate that the strength of the concrete masonry units are consistent with required compressive strength of the masonry construction shown on the drawings.
   b. Mortar: Submit the proportions of the mortar mix to verify compliance with the specified type.

2. Masonry work will not begin until test results are submitted to and approved by the Design Professional.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements. Provide certification of pull-out strength of all masonry ties and anchors. Submit certification of compliance with required standards for all masonry units. Submit one sample each of all masonry accessories items.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars and for steel templates for layout of dowels for columns and pilasters. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.

C. Material Test Reports:

1. For each type of concrete masonry unit required provide test results, measurements and calculations establishing net area compressive strength of units.

2. Mortar mix proportions for type of mortar required to achieve specified compressive strength of masonry.

3. Grout mix proportions according to ASTM C476 for the types of grout required for the work.

4. Testing and reports are to be completed by an independent laboratory.

D. Certificates: Prior to delivery, submit to Design Professional certificates attesting compliance with the applicable specifications for grades, types or classes of all products included in these specifications.

1. All materials required for mortar and grout including type, source, brand, and name of manufacturer.

2. Each combination of masonry unit type and mortar type. Include statement of net area compressive strength of masonry units, mortar type and net compressive strength of masonry determined according to Table 2 in ACI 530.1/ASCE 6/TMS 602

3. Mill Certificates: Steel producer's certificates of mill analysis, tensile and bend test for reinforcing steel required for project

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry materials to project in undamaged condition.

B. Store and handle masonry units to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion or other causes During freezing weather, protect masonry units with tarpaulins or other suitable material. If units become wet, do not install until they are dry.

C. At the time of delivery, the linear shrinkage of masonry units shall not exceed 0.065 percent.

D. Store cementitious materials and masonry units off the ground, under cover and in dry location. All materials must be protected from wetting by capillary action, rain, or snow, and protected from mud, dust, or other materials and contaminants likely to cause staining or defects.

E. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying in dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

F. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

G. Store masonry accessories, including metal items, in such a way as to prevent corrosion or accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Protection of Work: The Contractor shall construct and maintain temporary protection as required to permit continuous progress of the work. During erection, cover top of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

2. Where one wythe of multiwythe masonry walls is completed in advance of the other wythes, secure cover a minimum of 24 inches down the face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602

D. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg F or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

2. Comply with hot-weather preparation and construction provisions of ACI 530.1/ASCE 6/TMS 602

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. ASTM C 90.

(1) Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900psi minimum.
(2) Density Classification: Lightweight.
(3) Size (Width): Nominal thickness as indicated on the drawings. Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.2 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold weather construction.

B. Hydrated Lime: ASTM C 207, Type S.

C. Mortar Cement: ASTM C1329, Type S.

D. Aggregate for Mortar: ASTM C 144, except for joints less than 1/4" use aggregate graded with 100% passing the No. 16 sieve.

E. Aggregate for Grout: ASTM C 404

F. Water: Clean and potable. Mixing water must be free of harmful amounts of acids, alkalis, organic materials, or other substances that would adversely affect the quality or appearance of the mortar or the masonry units.

2.3 REINFORCING STEEL

A. Uncoated Steel Reinforcing Bars: ASTM A 615, including Supplement 1, Grade 60.

B. Epoxy-Coated Steel Reinforcing Bars: ASTM A 615, Grade 60, epoxy coated to comply with ASTM A 775.

C. Galvanized Steel Reinforcing Bars: ASTM A 767, Grade 60.

2.4 JOINT REINFORCEMENT, TIES AND ANCHORING DEVICES

A. General:

1. Comply with requirements indicated below for basic materials and with requirements indicated under each form of joint reinforcement, tie and anchor for size and other characteristics:

2. Manufacturers:

a. Provide products of one of the following:

(1) AA Wire Products Co.
(2) Dur-O-Wall, Inc.
(3) Hohmann & Barnard, Inc.
(4) National Wire Products Corp.
(5) Heckman Building Products

b. The Contractor shall submit technical literature for all reinforcing units.

3. Finishes: Provide reinforcement, ties, and anchors specified in subsequent paragraphs that are made from materials or that have the finishes that comply with the subparagraphs below, unless otherwise indicated.

a. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82 with ASTM A 153, Class B-2 coating
b. Stainless-Steel Wire: ASTM A 580 Type 304 or 316
c. Galvanized Steel Sheet: ASTM A 653 G60 commercial quality steel sheet, zinc coated.
d. Stainless-Steel Sheet: ASTM A 666, Type 304 or 316
e. Hot-Dip Galvanized Carbon Steel Sheet: ASTM A 1008cold-rolled, carbon steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153,
f. Steel Plates, Shapes, and Bars; ASTM A 36
g. Stainless Steel Bars: ASTM A 276 or ASTM A 666, Type 304

B. Joint Reinforcement: Provide welded-wire units prefabricated with deformed continuous side rods and plain cross rods in straight lengths of not less than 10 feet, with prefabricated corner and tee units, and complying with ASTM A951, hot-dipped galvanized, and the requirements indicated below:

1. Width: Fabricate joint reinforcement in units with widths a minimum of 2" less than nominal width of walls. Provide mortar coverage over joint reinforcement of not less than 5/8" on joint faces exposed to exterior and 1/2" elsewhere.

2. Wire Size for Side and Cross Rods:

a. 0.1875" diameter (W2.8.) for loadbearing or reinforced concrete masonry construction.

3. For single-wythe masonry provide either ladder or truss type with single pair of side rods and cross wires in ladder-type or points of connection in truss-type reinforcement spaced no more than 16 inches o.c.

C. Bent Wire Ties: Provide individual prefabricated bent-wire units complying with requirements indicated below:

1. Wire Size: 0.1875" diameter.

2. Length: Provide units of length indicated but not less than that required for embedment of at least 1 ½ " into the mortar bed of solid units or solid grouted hollow units and for a minimum of 1/2" embedment of tie end into outer face shells of hollow units, with not less than 5/8" mortar cover on exterior face joints, 1/2" elsewhere.

3. Tie Shape for Hollow Masonry Units Laid with Cells Vertical: Rectangular with ends welded closed and not less than 4" wide.

4. Tie Shape for Solid Masonry Units or hollow units laid with cells horizontal: Z-shaped ties with ends bent 90° to provide hooks not less than 2" long.

5. Type for Masonry Where Coursing Between Wythes Align: Unit ties bent from one piece of wire.

6. Type for Masonry Where Coursing Between Wythes Does Not Align: Adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 ". The maximum clearance between connecting parts of the tie shall be 1/16".

D. Adjustable Anchors: Where adjustable anchors are indicated for connecting masonry to structural framework, provide 2-piece assemblies as described below which permit vertical or horizontal differential movement between wall and framework parallel to, but resist tension and compression forces perpendicular to, plane of wall.

1. For anchorage to concrete framework, provide manufacturer's standard anchors with dovetail anchor section formed from 0.0966" thick sheet metal and triangular-shaped wire tie section sized to extend within 1" of masonry face.

2. For anchorage to steel framework provide manufacturer's standard anchors with crimped 1/4" diameter wire anchor section for welding to steel and triangular-shaped wire tie section sized to extend within 1" of masonry face.

3. Wire Size for triangular section: 0.1875" diameter.

E. Rigid Anchors: Provide straps of form and length indicated, fabricated from sheet metal strips of following width and thickness, unless otherwise indicated. Typical length to be 24" plus 2" long, 90° bends at ends.

1. Width: 1-1/2".

2. Thickness: 1/4".

F. Unit Type Masonry Inserts in Concrete: Furnish cast iron or malleable iron inserts of type and size indicated.

G. Dovetail Slots: Furnish dovetail slots, with filler strips, of slot size indicated, fabricated from 0.0336" (22 gage) sheet metal.

H. Anchor Bolts: Provide steel bolts with hex nuts and flat washers complying with ASTM A 307, Grade A, hot-dip galvanized to comply with ASTM A 153, Class C, in sizes and configurations indicated.

I. Postinstalled Anchors:

1. ICC Approval: Only anchors evaluated by the ICC Evaluation Service, Inc. (ICC-ES) with a published Evaluation Report specifically addressing anchorage to hollow or fully grouted concrete masonry shall be approved for use.

2. Type:

a. Hollow Concrete Masonry: Anchors into or through hollow concrete masonry units shall be the chemical type used with a galvanized or stainless steel screen tube that allows the chemical adhesive to create a key within the hollow cell of the unit.
b. Fully Grouted Concrete Masonry: Anchors into fully grouted masonry shall be either chemical anchors or expansion anchors specifically approved by ICC-ES for use in fully-grouted concrete masonry.

3. Finish:

a. Interior Exposure: All anchors, nuts and washers for use in interior environments free of potential moisture shall be manufactured from carbon steel, zinc plated in accordance with Federal Specification QQ-Z-325C, Type II, Class 3.
b. Exterior or Exposed Use: All anchors, nuts, and washers for use in exposed or potentially wet environments, or for attachment of exterior cladding materials shall be galvanized or stainless steel. Galvanized anchors, nuts and washers shall conform to ASTM A 153. Stainless steel anchors shall be manufactured from 300 series stainless steel and nuts and washers from 300 series or Type 18-8 stainless steel.

2.5 MISCELLANEOUS MASONRY ACCESSORIES

A. Non-Metallic Expansion Joint Strips: Premolded, flexible cellular neoprene rubber filler strips complying with ASTM D 1056, Grade RE 41E1, capable of compression up to 35%, of width and thickness indicated.

B. Premolded Control Joint Strips: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

1. Premolded PVC Control Joint Strips. Strips shall be polyvinyl chloride complying with ASTM D 2287, Type PVC 654-4 with a durometer hardness of 90.

C. Weepholes: Cotton Cord: Sash cord of length required to produce 2" exposure on exterior and 18" in cavity between wythes.

2.6 MORTAR AND GROUT MIXES

A. General:

1. Do not add admixtures including coloring pigments, air-entraining agent, accelerators, retarders, water repellent agent, anti-freeze compounds or other admixtures.

2. Do not use calcium chloride in mortar or grout.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for types of mortar required, unless otherwise indicated.

1. Limit cementitious materials in mortar to Portland cement-lime or mortar cement.

2. Use Type S mortar for reinforced masonry.

C. Grout for Unit Masonry:

1. Comply with ASTM C 476, proportion specification, for grout for use in construction of reinforced and nonreinforced unit masonry.

2. Grout consistency is to be coarse grout unless fine grout is required by ACI530/ASCE5/TMS402 based on minimum grout space dimensions coupled with maximum pour heights.

3. Satisfy all local codes for maximum aggregate size with respect to minimum clear opening to be grouted.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Inspect surfaces that are to support masonry work to assure completion to proper lines and grades and are free of dirt and other deleterious material. Do not begin work until surfaces not properly prepared have been satisfactorily corrected.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance

2. Verify that foundations or other supporting surfaces are within specified tolerances.

3. Verify that reinforcing dowels are properly spaced.

4. Examine rough-in and built-in construction to verify actual locations of piping connections.

B. Cleaning Reinforcing: Before placing, remove loose rust, ice and other coatings from reinforcing.

C. Installation, General:

1. Build cavity and composite walls, floors and other masonry construction to the full thickness shown. Build single-wythe walls (if any) to the actual thickness of the masonry units, using units of nominal thickness indicated.

2. Build chases and recesses as shown or required for the work of other trades. Provide not less than 8" of masonry between chase of recess and jamb of openings, and between adjacent chases and recesses.

3. Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.

4. Cut masonry units using motor-driven dry-cutting saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous patterns and to fit adjoining work. Use full-size units without cutting where possible. Do not use water-cooled saws for concrete masonry units.

5. Install cut units with cut surfaces and, where possible, cut edges concealed.

D. Do not install cracked, broken, or chipped masonry units exceeding ASTM allowances.

E. Protect sills, ledges, and offsets from mortar droppings or other damage during construction. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface. Remove misplaced mortar or grout immediately. Protect face materials against staining. Protect door jambs and corners from damage during construction.

F. Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted. Immediately remove grout or mortar in contact with such masonry.

G. Matching Existing Masonry Work: Match coursing, bonding, color and texture of new masonry work with existing work.

H. Mixing Mortar and Grout: Charging of the mixer shall be performed in the following order: First, add three quarters of the required water, one-half of the sand and all of the cementitious materials to the mixer and briefly mix together. Then add the balance of the sand, the aggregate (for grout) and the remaining water. Thoroughly mix cementitious material and aggregate for a minimum of three (3) minutes and a maximum of five (5) minutes after the last mixing water has been added to insure homogeneity and workability of the mortar or grout. The mixer should be charged to its full design capacity for each batch and completely empted before charging the next batch. If mortar begins to stiffen from evaporation or absorption of a part of mixing water, retemper by adding water and remix. Grout shall have a slump of ten and one-half (10 1/2) to eleven (11) inches at time of placement. Mortar shall be used within two and one-half (2 1/2) hours of initial mixing and no mortar shall be used after it has begun to set. Place grout within one and one-half (1 1/2) hours from introducing water in the mixture and prior to initial set.

3.2 CONSTRUCTION TOLERANCES

A. Comply with tolerance in ACI 530.1/ASCE 6/TMS 602 and the following.

B. For conspicuous vertical lines such as external corners, reveals, and expansion and control joints, do not exceed 1/4" in any story or 20 feet maximum, nor 1/2" maximum.

C. For vertical alignment of exposed head joints do not vary from plumb by more than 1/4" in 10 feet, nor 1/2" maximum.

D. Variation from Level: For conspicuous horizontal lines such as exposed lintels, sills, parapets, and reveals, do not exceed 1/4" in any bay or 10 feet maximum, nor 1/2" maximum. For top surface of bearing walls do not exceed 1/8" between adjacent floor elements in 10 feet or 1/16" within width of a single unit.

3.3 LAYING MASONRY WALLS

A. Do not wet concrete masonry prior to laying up units unless written permission is obtained from the Design Professional.

B. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate location of openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units, particularly at corners, jambs and wherever possible at other locations.

C. Lay-up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other work.

D. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern. Do not use units with less than nominal 4" horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses above and below

E. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2". Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4" horizontal face dimensions at corners or jambs.

F. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third unit for one-third running bond. Do not tooth. Clean exposed surfaces at set masonry and remove loose masonry units and mortar prior to laying fresh masonry.

G. Built-in Work: Install bolts, anchors, nailing blocks, inserts, frames, vent flashings, conduit, and other built-in items specified under this and other sections of these specifications as masonry work progresses. Avoid cutting and patching. Solidly grout spaces around built-in items. Provide joints around exterior framed openings 1/4" to 3/8" wide, raked and tooled smooth to a uniform depth of 3/4", ready for caulking by others. Build chases, do not cut. Consult other trades in advance and make provisions for installation of their work to avoid cutting and patching. Install chases minimum of one full masonry unit length from jambs.

1. Fill in space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.

2. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core, unless detailed otherwise.

3. Fill cores in hollow concrete masonry units with grout to supporting beam or slab below under bearing plates, beams, lintels, posts and similar items, unless otherwise indicated.

H. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.

1. For horizontally reinforced masonry, provide continuity at corners with prefabricated "L" units, in addition to masonry bonding.

I. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes and space as follows:

1. Provide individual metal ties at not more than 16" o.c. vertically.

2. Provide continuity with horizontal joint reinforcement using prefabricated "T" units.

J. Intersecting Load-bearing Walls: If carried up separately, block or tooth vertical joint with 8" maximum offsets and provide rigid steel anchors spaced not more than 4'-0" o.c. vertically, or omit blocking and provide rigid steel anchors at not more than 2'-0" o.c. vertically. If used with hollow masonry units, embed ends in mortar-filled cores.

3.4 MORTAR BEDDING AND JOINTING

A. Provide uniform nominal joint thickness of 3/8" for concrete masonry units, unless noted otherwise on the drawings.

B. Lay solid masonry units and fully-grouted hollow CMU with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not furrow bed joints or slush head joints.

C. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and in all courses of piers, columns and pilasters, and where adjacent to cells of cavities to be reinforced or filled with concrete or grout. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.

D. Joint Profile: Provide weather-proof, concave, tooled joints in exposed surfaces when mortar is thumbprint hard, using round jointing tool. Strike joints flush in surfaces to be plastered, stuccoed, or covered with other material or surface-applied finish other than paint. Concave tool exterior joints below grade. Remove mortar protruding into cells or cavities to be grouted. Do not permit mortar droppings to block weep holes. Do not fill horizontal joints between top of masonry partitions and underside of concrete or steel construction with mortar unless specifically shown on the drawings. If not shown otherwise, provide 1" clear joint to be filled with caulk. Keep movement joints clean of all mortar and debris. For tuckpointing, rake mortar joints to a depth of 1/2 to 3/4 in., saturate with clean water, fill solidly with pointing mortar, and tool to match existing joints.

E. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners of jambs to shift adjacent stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

F. Collar Joints: Unless otherwise required, After each course is laid, fill the vertical longitudinal joint between wythes solidly with mortar (grout if walls are grouted) for the following masonry work:

1. All multi-wythe walls of concrete masonry units in which the collar joint between wythes is less than ¾".

2. All below grade conditions.

3.5 CAVITY WALLS

A. Keep cavity clean of mortar droppings and other materials during construction. Strike joints facing cavity flush.

B. Provide weep holes in head joints in first course immediately above all flashing. Leave head joint free and clean of mortar or install weep hole tube in head joint. Space weep holes 32" on center maximum for concrete unit masonry. Keep weep holes and area above

3.6 HORIZONTAL JOINT REINFORCEMENT

A. General:

1. Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls, 1/2" elsewhere. Lap reinforcing a minimum of 6" at splices.

2. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

3. Reinforce walls with continuous horizontal joint reinforcing unless specifically noted to be omitted.

4. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

5. Space continuous horizontal reinforcement as follows:

   a. For single-wythe walls, space reinforcement at 16" o.c. vertically, unless otherwise indicated.
   b. For parapets, space reinforcement at 8" o.c. vertically, unless otherwise indicated.

6. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcement placed in two horizontal joints approximately 8" apart, immediately above the lintel and immediately below the sill. Extend reinforcement a minimum of 2'-0" beyond jambs of the opening except at control joints. Horizontal joint reinforcement interrupted by the jamb of an opening shall have the cross rod or side rod bent and hooked at the jamb. Provide an additional rectangular adjustable tie at the jamb for each joint not containing the normal horizontal reinforcing unit.

7. Provide reinforcement at openings in addition to other specified wall reinforcement.

3.7 PLACING REINFORCEMENT

A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Position reinforcement accurately at the spacing indicated. Prior to grouting, support and secure vertical bars against displacement. Vertical bars shall be held in position at the top and bottom and at intervals not exceeding 8'-0" with a minimum clearance of 1/4" if fine grout is used or 1/2" if coarse grout is used from the face of the masonry and not less than one bar diameter or 1" (whichever is greater) between adjacent bars.

C. For columns, piers and pilasters, provide a clear distance between vertical bars as indicated, but not less than 1-1/2 times the nominal bar diameter or 1-1/2", whichever is greater. Provide lateral ties as indicated.

D. All dowels shall be grouted into a cell even if the dowel is in an adjacent cell to the vertical steel. Unless detailed otherwise on the drawings, dowels shall be the same size and number as the vertical steel. Unless noted otherwise provide a lap length of dowels to vertical reinforcement equal to 50 times the nominal dowel diameter. Dowels for columns and pilasters shall be set using 1/8" thick steel plate templates. Templates shall be detailed and submitted with reinforcing steel shop drawings.

E. All horizontal reinforcing steel shall be placed in continuous bond beam or lintel block units and shall be solidly grouted in place. Maintain a minimum of one bar diameter or 1" (whichever is greater) clearance between adjacent bars and a minimum of 1/4" clearance if fine grout is used or 1/2" if coarse grout is used from the face of the masonry. Horizontal reinforcement may be placed as the masonry work progresses.

F. Splice reinforcement bars where shown; do not splice at other points unless acceptable to the Design Professional. Where splices occur, adjacent splices shall be staggered so that no more than 25% of the total number of bars are spliced at any one point with a minimum stagger between splices in adjacent bars of at least the lap length. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie. Minimum lap splice length shall be 50 bar diameters unless indicated otherwise.

G. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.

3.8 FORMWORK AND SHORES

A. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.

B. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar, grout, or concrete (if any). Brace, tie and support as required to maintain position and shape during construction and curing of reinforced masonry.

C. Formwork shall be designed and shop drawings prepared by a registered professional engineer in the state where the project is located.

D. Formwork shall not be removed until the reinforced masonry member has cured sufficiently to carry its own weight and any other loads that may be placed on it during construction. Allow not less than the following minimum time to elapse after completion of the member before removing shores or forms provided adequate curing conditions have been obtained during the curing period:

1. Lintels and beams - 10 days.

2. Reinforced masonry soffits - 7 days.

3. Allow 16 hours to elapse after completion of masonry columns and walls before placing floor or roof construction loads. Allow an additional 48 hours before applying concentrated loads such as girders, beams, or trusses.

3.9 GROUTING

A. General: Where detailed, grout in reinforced masonry walls, columns, and pilasters. Fully grout vertical cells of concrete masonry containing steel reinforcement.

B. Specification: Comply with the requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts, grout space preparation, and grout placement, including minimum grout space, maximum pour height, maximum lift height and consolidation.

1. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

2. Place grout by pumping into grout spaces.

3. Place grout in lintels or beams over openings in one continuous pour.

4. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 1" of vertically reinforced cavities, during construction of masonry.

5. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 1-1/2" of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

3.10 CONTROL AND EXPANSION JOINTS

A. General: Provide vertical and horizontal expansion, control and isolation joints in masonry where shown. Build-in related items as the masonry work progresses.

B. Where control joints are not indicated on the drawings the Contractor shall submit a proposed control joint layout for Design Professional approval. General guidelines for control joint locations are as follows:

1. At major changes in wall height

2. At changes in wall thickness

3. At corresponding control joints in foundations, floor, or roof construction

4. At one or both sides of wall openings (masonry veneer only)

5. Near wall intersections

6. At column centerlines.

C. Maximum Spacing: Maximum control joint spacing in concrete masonry construction shall be such that the ratio of wall length to height shall not exceed 1.5 with a maximum spacing of 25 feet.

D. Form control joints in concrete masonry as follows:

1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake joints in exposed faces.

2. Install preformed control-joint gaskets designed to fit standard sash block.

3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake joint.

4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete.

E. Build in horizontal pressure relieving joints where indicated; construct joints by inserting non-metallic compressible joint filler of width required to permit installation of sealant and backer rod.

F. Provide continuous bond break at steel columns and members.

G. Provide pressure-relieving joints by adhering a continuous 3/8" thick neoprene pad below shelf angles supporting masonry veneer.

H. Leave joints around outside perimeters of exterior doors, window frames and other wall openings:

1. Depth: Uniform 3/4 in. (19mm).

2. Width: 1/4 in. (6.4 mm) to 3/8 in. (9.5mm).

3.11 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and wherever openings of more than 2'-0" for block size units are shown without structural steel or other supporting lintels.

1. For hollow concrete masonry unit walls, use specially formed U-shaped lintel units with reinforcement bars placed as shown filled with coarse grout.

C. Provide minimum bearing of 8" at each jamb, unless otherwise indicated.

3.12 PARGING

A. Parge walls where indicated with Type S or N mortar, in thickness indicated. Thickness: Not less than 1/2".

B. Trowel finish to a smooth, dense surface. Form a wash at top of parging and a cove at bottom. Where parging is applied in 2 coats, roughen first coat when partially set, let harden for 24 hours and moisten prior to application of second coat.

C. Damp cure parging for at least 24 hours and protect until cured.

3.13 REPAIR, POINTING AND CLEANING

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing:

1. During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Pointup all joints including corners, openings and adjacent work to provide a neat, uniform appearance, prepared for application of sealants. If the repairs must be made after the mortar has hardened, the joint must be raked or chiseled out to a depth of about 1/2" thoroughly wetted, and repointed with fresh mortar.

2. To prehydrate mortars, thoroughly mix all ingredients except water in proportions used for original mortar mix; then mix again, adding only enough water to produce a damp unworkable mix which will retain its form when pressed into a ball. After 1 to 2 hours, add sufficient water to bring it to the proper consistence; that is conventional masonry mortars.

C. Final Cleaning: After mortar is thoroughly set and cured, clean masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain **Design Professional's** approval of sample cleaning before proceeding with cleaning of masonry.

3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film or waterproof masking tape.

4. Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clean water.

5. Clean concrete unit masonry to comply with masonry manufacturer's directions and NCMA Tek 8-2 bulletin.

D. Protection and Cleanup:

1. Provide final protection and maintain conditions in a manner acceptable to Installer, which ensure unit masonry work being without damage and deterioration at time of substantial completion.

2. Leave work area and surrounding surfaces clean and free of mortar spots, droppings, and broken masonry.

END OF SECTION

SECTION 04 7200

CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes cast stone masonry and supplementary items necessary to complete their installation.

B. Water repellent for cast stone masonry is specified in Division 07 Section "Water Repellents".

1.2 DEFINITIONS

A. Cast Stone: Highly refined architectural precast concrete building stone manufactured from mixture of Portland cement and coarse and fine aggregates, to simulate natural stone and generally used as masonry product, as an architectural feature, trim, ornament, or facing for buildings and other structures.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for cast stone masonry units.

B. Shop Drawings: Show fabrication and installation details for cast stone masonry units. Include dimensions; details of reinforcement and anchorages, if any; and indication of finished faces.

1. Include building elevations showing layout of units and locations of joints and anchors.

C. Stone Samples: For each color and texture of cast stone masonry required, 10 inches square in size.

D. Full-Size Samples: For each type of cast stone masonry unit required. Make available for Architect's review at Project site before installing cast stone. Approved Samples may be installed in the Work.

E. Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of cast stone masonry with requirements indicated.

1. Certificates: In lieu of agency test reports, submit certificates signed by manufacturer certifying that cast stone masonry complies with requirements specified.

1.4 QUALITY ASSURANCE

A. Standards: Comply with provisions of Cast Stone Institute standard specification and technical bulletins.

B. Manufacturer Qualifications: A firm experienced in manufacturing cast stone masonry units similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to manufacture required units.

C. Source Limitations for Cast Stone: Obtain cast stone masonry units through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship cast stone masonry units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone masonry units, if required, using dollies with wood supports.
2. Store cast stone masonry units on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

PART 2 - PRODUCTS

2.1 CAST STONE MASONRY MATERIALS

A. General: Comply with ASTM C 1364 and the following:

B. Portland Cement: ASTM C 150, Type I, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Color as required to produce finish specified.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation and color as needed to produce required textures and finish.

D. Fine Aggregates: Manufactured or natural sands complying with ASTM C 33, gradation and color as needed to produce required textures and finish.

E. Air-Entraining Admixture: ASTM C 260, certified by the manufacturer to be compatible with other admixtures used.

1. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 5 to 7 percent.

F. Reinforcement: Deformed steel bars complying with ASTM A 615, Grade 60.

1. Epoxy Coating: ASTM A 775.
2. Galvanized Coating: ASTM A 767.

G. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 276 or ASTM A 666, Type 304.

H. Color Pigments: ASTM C 979, Inorganic (natural or synthetic) iron oxide pigments excluding use of carbon black pigment, and guaranteed by pigment manufacturer to be lime-proof. Amount of pigment shall not exceed 5 percent by weight of cement used.

2.2 CAST STONE MASONRY UNITS

A. Provide architectural cast stone masonry units complying with ASTM C 1364.

1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666, Procedure A, as modified by ASTM C 1364.

B. Reinforce units as indicated and as required by ASTM C 1364. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of material.

C. Fabricate units with sharp arris and details accurately reproduced with indicated texture on all exposed surfaces, unless otherwise indicated.

1. Slope exposed horizontal surfaces at least 1:12, unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements, unless otherwise indicated.
4. Fillet outside corners: 1/2 inches.

D. Cure and finish units as follows:

1. Cure units in totally enclosed curing room under dense fog and water spray at 95 percent relative humidity for 24 hours.
2. Yard cure units until the sum of the mean daily temperatures for each day equals or exceeds 350 deg F.
3. Acid etch units to remove cement film from surfaces indicated to be finished.

E. Color and Texture: Provide units with fine-grained texture and buff color resembling Indiana limestone.

2.3 MORTAR MATERIALS

A. Provide mortar materials that comply with Division 4 Section "Masonry Veneer".

2.4 ACCESSORIES

A. Anchors: Type quantity and size required to support cast stone masonry cladding and to sustain imposed loads, fabricated from stainless steel complying with ASTM A 276 or ASTM A 666, Type 304.

B. Dowels: Round stainless-steel bars complying with ASTM A 276, Type 304, 1/2-inch-diameter.

2.5 MORTAR MIXES

A. Comply with requirements in other Division 04 Unit Masonry Section for mortar mixes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive cast stone masonry and associated work and conditions under which stone will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as applicator's acceptance of installation conditions.

3.2 INSTALLATION

A. Install cast stone masonry units to comply with requirements specified in other Division 04 Unit Masonry Sections for installing stone units in walls with other masonry units.

B. Install anchors, supports, fasteners, and other attachments necessary to secure units in place. Set units accurately in locations indicated with edges and faces aligned according to established relationships with other masonry units and indicated tolerances.

C. Drench units with clear water just before setting.

D. Set units in full bed of mortar with full head joints, unless otherwise indicated. Build anchors and ties into mortar joints as units are set.

1. Fill dowel holes and anchor slots with mortar.
2. Fill collar joint solid as units are set.
3. Build concealed flashing into mortar joints as units are set in accordance with other Division 04 Unit Masonry Sections.
4. Leave head joints open in coping and other units with exposed horizontal surfaces. Keep joints clear of mortar, and rake out to receive sealant.

E. Rake out joints for pointing with mortar to depths of not less than 3/4 inch. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

F. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.

G. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

H. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated.

1. Sealing joints is specified in Division 07 Section "Joint Sealants."
2. Keep joints free of mortar and other rigid materials.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 3/8 inch maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not exceed 1/16-inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.4 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone masonry may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone masonry matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone masonry as work progresses. Remove mortar fins and smears before tooling joints.

D. Comply with requirements in other Division 04 Unit Masonry Section for final cleaning.

END OF SECTION

SECTION 05 1200

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of structural steel work is shown on drawings including schedules, notes and details that show size and location of members, typical connections, and type of steel required. Furnish all labor, materials, services, equipment and appliances required in conjunction with or related to the furnishing, fabrication, delivery, and erection of all structural steel defined below. Include all supplementary parts, members and connections necessary to complete the structural steel work, regardless of whether all such items are specifically shown or specified on the drawings.

B. Structural steel shall be defined as that work prescribed in Section 2.1 of the AISC "Code of Standard Practice for Steel Buildings and Bridges" and all steel supports for elevator guide rails .

C. Miscellaneous metal fabrications, architecturally exposed structural steel, metal stairs and ladders, steel joists and joist girders, cold-formed metal framing, and metal deck are specified elsewhere in these Specifications.

1.3 ENVIRONMENTAL OBJECTIVES

A. The Owner has established environmental goals and strategies for achieving them based upon the LEED® Green Building Rating System for New Construction & Major Renovations Version 2.2 dated October 2005, as developed by the U.S. Green Building Council. Refer to Division 01 Section "Sustainable Design Requirements."

B. Manufacturer to supply documentation of compliance with the following requirements before consideration as an "acceptable manufacturer:"

1. The following are mandatory requirements for the overall project:

   a. The material(s) in the product(s) supplied should have a recycled content such that the sum of the post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 20% of the total value of the material in the project.
   b. 20% of the product(s) supplied is extracted, processed, and manufactured regionally within a radius of 500 miles of this Project.
   c. Paints and coatings must meet or exceed the VOC and chemical component limits of Green Seal requirements.

C. Products that conform to requirements of the Environmental Objectives yet do not fully meet other requirements of this Section may still be considered for use at the sole discretion of the Design Professional.

1.4 QUALIFICATIONS

A. Fabricator:

1. The structural steel fabricator shall have not less than 5 years experience in the successful fabrication of structural steel similar to this project.

2. The fabricator should be an AISC Certified Fabricator for Buildings.

3. The structural steel fabricator must be approved by the Design Professional to perform fabrication work without special inspection. Should the fabricator not be so approved, the fabricator shall reimburse the Design Professional for the cost of the special inspections required by the local building official.

B. Detailer:

1. The structural steel detailer shall have not less than 2 years experience in the successful detailing of structural steel similar to this project including experience in selecting or completing structural steel connection details using information found in tables in the AISC "Steel Construction Manual.

C. Erector:

1. The structural steel erector shall have not less than 2 years successful experience in the erection of structural steel of a similar nature to this project.

D. Professional Engineer: A professional engineer who is licensed to practice engineering in the state the project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material,

1. The Professional Engineer employed by the Fabricator for connection design shall be experienced in the specific area of structural steel connection design with demonstrated experience of not less than three projects of similar scope and complexity.

E. Independent Testing Laboratory: Any testing laboratory retained to perform tests that are required by this specification shall meet the basic requirements of ASTM E329

1.5 QUALITY ASSURANCE

The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

A. Codes and Standards: Comply with provisions of following, except as otherwise indicated. For codes and standards for which no specific version is referenced, the version that is referenced in the applicable building code shall govern, or, if there is no reference in the building code, the latest version of the code or standard shall govern except as otherwise noted in the AISC Steel Construction Manual, 13th edition. Certain sections in this specification contain requirements that are more restrictive and/or different than contained in the standards listed. In such cases, the requirements of this specification shall control.

1. All federal (OSHA), state and local laws that govern safety requirements for steel erection and other requirements if more stringent than the codes and standards enumerated below. OSHA requirements include regulation 29 CFR 1926, Part R, "Safety Standard for Steel Erection".

2. AISC "Code of Standard Practice for Steel Buildings and Bridges," adopted March 18, 2005, except as noted herein.

   a. Certain sections in this specification contain requirements that are more restrictive and/or different than contained in this standard. In such cases, the requirements of this specification shall control.

3. ANSI/AISC 360, "Specification for Structural Steel Buildings".

4. RCSC "Specification for Structural Joints using ASTM A325 or A490 Bolts".

5. AISC "Steel Construction Manual", Thirteenth Edition, 2005

6. ANSI/AISC 341, "Seismic Provisions for Structural Steel Buildings", Including "Supplement No. 1".

7. ANSI/AWS D1.1 "Structural Welding Code - Steel.

8. ANSI/AWS D1.8 "Structural Welding Code – Seismic Supplement"

9. "SSPC Painting Manual", Volumes 1 and 2.

B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Structural Welding Code - Steel". In addition, welding operators making complete-joint-penetration welds on the bottom beam flange connection to column flanges in Seismic Load Resisting Systems as designated on the drawings and that are designated as Demand Critical Welds shall be qualified in accordance with AWS D1.8, Section 5.

C. Source Quality Control: Materials and fabrication procedures are subject to inspection and tests in the mill, shop, and field by the Design Professional's testing laboratory. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements. The Contractor shall promptly remove and replace materials or fabricated components which do not comply.

D. Questions about Contract Documents: The Contractor shall promptly notify the Design Professional whenever design of members and connections for any portion of the structure are not clearly indicated or when other questions exist about the Contract Documents. Such questions shall be resolved prior to the submission of shop drawings.

E. Design Professional's Testing Laboratory Services: Inspection or testing by the Design Professional does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents

F. Surveyor: The General Contractor shall employ a qualified land surveyor to perform surveys required by this specification.

1.6 SUBMITTALS

A. Product Data: Submit producer's or manufacturer's specifications and installation instructions for following products; include laboratory test reports and other data to show compliance with specifications (including the specified standards):

   1. Fabricators Certificate of Compliance: The fabricator shall provide a "Fabricators Certificate of Compliance", a copy of the shop certification from AISC or building code evaluation services report.

2. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties. For structural steel for which evidence exists that the steel may not conform to ASTM requirements, the contractor, where permitted by the Design Professional, shall engage the services of an independent testing laboratory to test the material according to ASTM A6 and submit certified test reports that verify conformity to ASTM standards. Tests shall be made for each 10 tons of affected material unless otherwise directed by the Design Professional.

3. High-strength bolts (each type), including nuts and washers, including certified copies of mill reports covering physical and chemical properties.

4. Shrinkage-resistant grout.

5. Unfinished bolts and nuts.

6. Welding electrodes (each type).

7. Structural steel primer paint.

8. Shear studs.

9. Direct tension indicators.

B. LEED Submittals

1. Recycled Content- Credit MR4.1/MR 4.2: Provide documentation indicating percentages of post-consumer and pre-consumer recycled content by weight per unit of product or assembly containing the product. Indicate the percentage of the dollar value of the recycled content compared to the total dollar value of the product or assembly containing the product.

2. Material Proximity- Credit MR 5.1/MR 5.2: When the distance to the project site is 500 miles or less, indicate location and distance to project site of extraction, harvesting, recovery, and manufacturing of all materials. Indicate the dollar value of the material cost of the product containing local/regional materials. Where product components are sourced or manufactured in separate locations, provide location and percentage by weight of each component per unit of product.

C. Shop Drawing and Erection Drawings:

1. All drawings submitted for review shall have the approved shop drawing stamp of the Design Team as part of the title block. The approved shop drawing stamp will be provided in electronic format to the successful bidder.

2. Definitions:

   a. Shop Drawings: Drawings of the individual structural steel shipping pieces that are to be produced in the fabrication shop.
   b. Erection Drawings: Field-installation or member-placement drawings that are prepared by the Fabricator to show the location and attachment of the individual shipping pieces.
   c. Erection-Bracing Drawings: Drawings that are prepared by the Erector to illustrate the sequence of erection, any requirements for temporary supports and the requirements for raising, bolting, and/or welding. These drawings are in addition to and separate from the Erection Drawings.

3. Shop Drawings: Submit for review and approval shop drawings showing complete details and schedules for fabrication and assembly of structural steel members. The licensed professional engineer responsible for the design of any of the connections shown on the shop drawings shall submit a letter that is sealed attesting that the connection design engineer has reviewed the shop drawings and that the connections designed by the engineer conform to the engineer's design.Structural steel shop drawings shall include the following minimum information:

    a. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify the type of high-strength bolted connection (slip-critical, direct-tension, or bearing connections). Holes, flange cuts, slots and openings shall be made as required by the structural drawings, all of which shall be properly located by means of templates.
    b. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.
    c. Shop drawings containing designed elements (connections) by fabricator's engineer must be signed and sealed.

4. Erection Drawings: Submit for review and approval complete erection drawings showing field-installation and member-placing instructions for locating and attaching the individual shipping pieces.

5. The fabricator alone shall be responsible for all errors of detailing, fabrication, and for the correct fitting of the structural members.

6. All fabricated material and connections shall fit within architectural constraints.

7. Structural steel members for which shop drawings have not been reviewed and approved shall not be fabricated.

8. The omission from the shop drawings of any materials required by the Contract Documents shall not relieve the Contractor of the responsibility of furnishing and installing such materials, even though the shop drawings may have been reviewed and approved.

D. Calculations: The fabricator's engineer shall submit complete signed and sealed design calculations showing all information as specified in Part 2- Connections. The Design Professional reserves the right to reject all shop drawings submitted without complete design calculations.

E. Surveys: Submit the information requested for all surveys required by this specification.

F. Test Reports: Submit certified reports of tests required by this Specification Section. Include data on type(s) of tests conducted and test results.

G. Qualification Data:

1. Submit qualification data, including required certifications, for firms and persons specified in Article 1.4 "Qualifications" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

2. Submit Welding Procedure Specifications (WPS) in accordance with ANSI/AWS D1.1 for all welded joints. Submit test reports showing successful passage of qualification tests for all non-prequalified WPSs.

3. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests as specified in section 1.05-B. If recertification of welders is required, retesting will be at Contractor's responsibility.

4. The fabricator shall submit a 'Fabricator's Certificate of Compliance' as outlined in section 014529 to show that they are approved to perform fabrication without special inspection shall submit a certificate of compliance stating that the work was performed in accordance with the approved construction documents.

H. Substitutions:

1. Substitutions for the member sizes, type(s) of steel connection details or any other modifications proposed by the Contractor will be considered by the Design Professional only under the following conditions:

   a. That the request has been made and accepted prior to the submission of shop drawings. All substitutions shall be clearly marked and indicated on the shop drawings as a substitute.
   b. That there is a substantial cost advantage or time advantage to the Owner; or that the proposed revision is necessary to obtain the required materials or methods at the proper times to accomplish the work in the time scheduled.
   c. That sufficient sketches, engineering calculations, and other data have been submitted to facilitate checking by the Design Professional, including cost reductions or savings in time to complete the work.
   d. In no case shall such revisions result in additional cost to the Owner.

1.7 PRE-CONSTRUCTION CONFERENCE

A. At least 14 days prior to beginning structural steel erection, the Contractor shall hold a meeting to review the detailed quality control and construction requirements and to determine the procedures for producing proper structural steel construction. Also review requirements for submittals, status of coordinating work and availability of materials. Establish work progress schedule and procedures for materials inspection, testing and certifications.

B. The Contractor shall require responsible representatives of every party who is concerned with the structural steel work to attend the conference, including but not limited to the following:

Contractor's Superintendent
Laboratory responsible for field quality control
Structural Steel Detailer
Structural Steel Fabricator
Structural Steel Erector
Design Professional's Representative
Owners Representative.

C. Minutes of the meeting shall be recorded, typed and printed by the Contractor and distributed by him to all parties concerned within 5 days of the meeting. One copy of the minutes shall be transmitted to the following for information purposes:

Design Professional's Representative
Design Profesional
Owners Representative.

D. The Professional shall be present at the conference. The Contractor shall notify the Design Professional at least 7 days prior to the scheduled date of the conference.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time so as not to delay work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration. Do not store materials on structure in a manner that might exceed allowable loads on or cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed by Design Professional.

D. Furnish all fuel, maintenance, and equipment required for hoisting and placement of materials under this contract.

E. Process, pay for and maintain all permits and certificates of on-site inspection required for derricks, cranes and hoisting equipment. No derrick, crane or hoisting equipment shall be operated without a certificate of operation and a certificate of on-site inspection, as required by governing authorities.

1. In addition to the above, all hoisting equipment shall be installed, operated and maintained in accordance with all applicable regulations of authorities having jurisdiction.

2. The Contractor shall furnish street storage and sidewalk crossing permits.

1.9 JOB CONDITIONS

A. The Contractor shall coordinate the fabrication and erection of all structural steel work with the work of other trades.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel: All hot rolled steel plates, shapes, sheet piling, and bars shall be new steel conforming to ASTM A6.

B. Structural steel shall comply with the provisions of the following ASTM Specifications as appropriate for the grades and types, and at the locations as specified on the drawings:

1. Structural Steel Wide Flange and WT Shapes - High Strength Steel, ASTM A992. ASTM A572, Grade 50 is acceptable as a substitute for A992.

2. M-Shapes, S-Shapes, and Channels - Carbon Steel, ASTM A36.

3. Angle Shapes – Carbon Steel, ASTM A36.

4. Structural Steel Plates and Bars - Carbon Steel, ASTM A36.

5. Round HSS - ASTM A500 Grade B (Fy = 42 ksi) or ASTM A501 with written approval from the Design Professional.

6. Square and Rectangular HSS – ASTM A500, Grade B (Fy = 46 ksi).

7. Connection Material: Unless noted otherwise on the drawings, column stiffener plates and doubler plates at moment connections shall be the same grade of steel as the beam connecting the column (highest grade if more than one grade is used). All other connection material except as noted otherwise on the drawings including bearing plates, gusset plates, stiffener plates, filler plates, angles, etc. shall be A36 steel unless a higher or matching grade of steel with the members connected is required by strength or stiffness calculations and provided the resulting sizes are compatible with the members connected.

C. Structural Steel Surfaces: For fabrication of work which will be exposed to view in the completed structure, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.

D. Structural Bolts and Threaded Fasteners: Structural bolts and threaded fasteners shall comply with the following ASTM Specifications as appropriate for the types and at the locations as specified on the drawings:

1. ASTM A325 Type 1.

2. ASTM A490 Type 1.

3. Alternative Design Fasteners: Fasteners that incorporate a design feature intended to indicate a predetermined tension or torque (load indicator bolts or "twist-off" bolts) shall conform to the requirements of section 2.8 of the RCSC "Specification for Structural Joints Using ASTM A325 or A490 Bolts".

   a. Bolts that are manufactured to conform to ASTM A325 shall additionally conform to ASTM F1852.
   b. Bolts that are manufactured to conform to ASTM A490 shall additionally conform to ASTM F2280.
   c. Acceptable manufacturers include:
      (1) Nucor Fastener, A Division of Nucor Corporation, Conway, AR and St. Joe, IN.
      (2) Lake Erie Screw Corp., Lakewood, OH.
      (3) Vermont Fasteners Manufacturing, Swanton, VT.
      (4) Lohr Structural Fasteners, Humble TX.

4. Threaded Round Stock:

5. Bolts and Nuts, High Strength Bolts: Bolts and nuts for all high strength bolts shall be heavy hex head conforming to ANSI Standards B18.2.1 and B18.2.2 respectively. Nuts shall conform to ASTM A563.

6. Washers: All washers shall be circular, flat and smooth and shall conform to the requirements of Type A washers in ANSI Standard B23.1. Washers for high strength bolts shall be hardened and conform to ASTM F436. Beveled washers for American Standard Beams and channels shall be square or rectangular, shall taper in thickness (16 2/3% slope) with an average thickness of 5/16". When an outer face of a bolted part has a slope greater than 1:20 with respect to a plane normal to the bolt axis, a beveled

washer shall be used. Washers to be used with A490 bolts larger than 1 inch in diameter and installed over oversized or short-slotted holes and other similar situations shall conform to ASTM F436 except with 5/16 inch minimum thickness.

7. Bolt Lubrication: All bolts shall be well lubricated at time of installation. Dry, rusty bolts will not be allowed.

8. New Bolts: All bolts shall be new and shall not be reused.

E. Electrodes for Welding:

1. Electrodes for various welding processes shall be as specified below:

   a. SMAW:
      (1) E70XX low hydrogen
   b. SAW:
      (1) F7X-EXXX
   c. GMAW:
      (1) ER70S-X
   d. FCAW:
      (1) E7XT-X

2. Electrodes shall be compatible with parent metal joined.

F. Anchor Rods:

1. All anchor rods shall conform to ASTM F 1554. unless noted otherwise on the drawings and shall be of the yield strength as specified below as appropriate for the types and at the locations as specified on the drawings:

   a. Grade 55 (1/4 inch to 4 inches in diameter).(Also comply with Supplementary Requirement S1 of ASTM F1554)

2. Nuts: All nuts with anchor rods shall be heavy hex head conforming to ASTM A563.

3. Washers: Unless indicated otherwise, washers for all base plates shall be in accordance with the AISC "Steel Construction Manual", Table 14-2 with holes 1/16" larger than the anchor rod diameter. Washers shall conform to ASTM A36 steel.

G. Structural Steel Primer Paint:

1. Unless noted otherwise, primer paint shall be one of the following types with the indicated surface preparation:

   a. SSPC-Paint 25.1, Type II; zinc oxide, raw linseed oil and alkyd primer, surface prepared according to SSPC-SP-2 (Hand Tool Cleaning) unless noted otherwise in this specification.
   2. Refer to Architect's drawings and specifications for final paint finish requirements of structural steel. Primer paint shall be compatible with final paint requirements.

H. Non-Shrink Grout: Provide grout type(s) as specified on the drawings:

1. Non-Metallic Non-Shrink Grout: Premixed, non-corrosive, non-staining product containing Portland cement, silica sands, shrinkage compensating agents, and fluidity improving compounds. Conform to ASTM C1107. Provide the minimum strength as shown below as determined by grout cube test at 28 days:

a. 6,000 PSI for supporting concrete 3000 psi and less.
b. 8,000 PSI for supporting concrete greater than 3000 psi and less than or equal to 4000 psi.
c. Unless noted otherwise on the drawings, grout strength on supporting concrete greater than 4000 psi shall be 8000 psi.

Acceptable non-shrink grouts include:

"Crystex" and "Duragrout" as manufactured by L&M Construction Chemicals, Inc.

"Sure Grip High Performance Grout," and "1107 Advantage Grout" as manufactured by Dayton-Superior Corporation.

"Masterflow 555", and "Set Grout" as manufactured by BASFConstruction Chemicals, MBT Protection and Repair Products.

"Five Star Grout" as manufactured by U.S. Grout Corp.

"NS Grout" as manufactured by The Euclid Chemical Company.

"CG 200 PC", Hilti, Inc.

I. Hot Dip Galvanizing:

1. Scope: All structural steel items and their connections permanently exposed to exterior conditions or that are within areas of unconditioned airspace, whether specified on the drawings or not, shall be hot-dipped galvanized after fabrication unless indicated on the drawings or in **Painting Specification** to receive a primer and/or finish coat. Such items include, but are not limited to:

   a. Base plates and anchor rods supporting galvanized members shall also be galvanized.
   b. Shelf angles.
   c. Parapet wall supporting members.
   d. Screen wall supporting members.
   e. Embedded plates in concrete exposed to unconditioned airspace.
   f. Other items as noted on the drawings.

   Examine the architectural and structural drawings for other items required to be hot dipped galvanized.

   Zinc-coat all ASTM A325 bolts nuts, and washers used in the connection of such steel. Field welded connections shall have welds protected and the exposed portions of ASTM A490 bolts, nuts and washers shall be protected with galvanizing repair paint.

2. Surface Preparation: All steel to be hot dip galvanized shall undergo the following surface preparation as specified by the Steel Structures Painting Council (SSPC), Volume 2.

   a. Remove all grease, oil, grime and foreign contaminants by thorough cleaning with an alkaline or organic solvent followed by thorough rinsing in cold water.
   b. Remove scale by pickling in diluted sulfuric or hydrochloric acid. Pickling shall be followed by a rinse in warm water and a second rinse in cold water. As an

alternative to pickling, the steel may be white metal blast cleaned according to SSPC-SP-5.

c. Dip in a flux solution of zinc ammonia chloride followed by drying at room temperature.

3. Zinc Coating: The zinc coating for steel shapes and plates shall conform to ASTM A123. Weight of zinc coating per square foot of surface for 1/8 inch and 3/16" thick steels shall average not less than 2.0 oz. with no individual thickness less than 1.8 oz. The coating weight shall average not less than 2.3 oz. with no individual thickness less than 2.0 oz. for 1/4" thick and heavier steel.

J. Galvanizing Repair Paint: Galvanizing repair paint shall be have 95% zinc solids by volume and shall comply with SSPC-Paint 20.

2.2 FABRICATION

A. Shop Fabrication and Assembly:

1. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specification and as indicated on approved final shop drawings. Provide camber in structural members where indicated. Fabricator shall coordinate connection details, joint fit-up procedures, and field adjustment requirements with erector. The General Contractor shall coordinate provision of all erection bolts, lifting lugs or other devices required for erection with the fabricator and the erector and for interference with architectural finishes and constraints.

2. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

3. Clearly mark the grade of steel on each piece, distinguishable in the field from floor surfaces, for purpose of field inspection and confirmation of grade of steel.

4. Milled surfaces of built-up sections shall be completely assembled or welded before milling.

5. Fitted stiffeners shall be fabricated neatly between flanges, and the ends of stiffeners shall be milled or ground to secure an even bearing against abutting surfaces. All milled or ground joints shall bear throughout their contact length.

6. Bolted joints in the Seismic Load Resisting Systems shall have a class A faying surface unless noted otherwise and except in end-plate moment connections. The bolts shall be pre-tensioned high-strength bolts.

B. Dimensional Tolerances: Dimensional tolerances of fabricated structural steel shall conform to Section 6.4 of the AISC Code of Standard Practice.

C. Camber:

1. Camber of structural steel members is indicated on the drawings.

2. Where possible, camber of beams shall be applied by a cold bend process.

3. The local application of heat may be used to introduce or correct camber, curvature, or straightness provided the temperature of the heated area, as measured by temperature crayons or other approved means, does not exceed 1200°F.

4. Where indicated on the drawings in a camber diagram, cantilever or double cantilever beams shall be cambered for the main span and cantilever end separately, either by a staged cold bending process or by the application of heat.

5. Beams and trusses detailed without specified camber shall be fabricated so that after erection any natural camber due to rolling or shop fabrication is upward.

6. Specified camber for beams shall be in accordance with the AISC "Code of Standard Practice".

D. Splices in Structural Steel: Splicing of structural steel members in the shop or the field is prohibited without prior approval of the Design Professional. Any member having a splice not shown and detailed on approved shop drawings will be rejected.

E. Compression Joints: Ends of columns, except as otherwise noted, and other compression joints at splices and other connections as noted on the drawings which depend on contact bearing as part of the splice strength shall be finished to bear in accordance with AISC Specification M2.6 so as to provide complete true bearing in accordance with AISC Specification M4.4.

F. Cutting: Manual oxygen cutting shall be done only with a mechanically guided torch. An unguided torch may be used provided the cut is not within 1/8 inch of the finished dimension and final removal is completed by means such as chipping or grinding to produce a smooth surface quality free of notches or jagged edges. All corners shall be smooth and rounded to a minimum 1/2" radius.

G. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members as shown on the contract documents, and/or the final shop drawings.

1. Provide specialty items as indicated to receive other work.

2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

H. Lifting and Erection Devices: The fabricator shall be responsible for designing, detailing and furnishing all lifting devices and erection aids required for erection. Such devices shall be removed after erection if they interfere with architectural finish requirements.

I. Drainage Holes: Provide 1 inch diameter drainage (weep) holes in all members (trusses, girders, beams, etc.) exposed to weather where rain water could collect (at low points and/or behind dams caused by connections, stiffener plates, etc.). Show all holes on shop drawings for review by the Design Professional.

2.3 WELDING

A. Code: All shop and field welding shall conform to all requirements in the "Structural Welding Code - Steel", ANSI/AWS D1.1, as published by the American Welding Society (AWS).

B. Welder Certification: All shop and field welders shall be certified according to AWS procedures for the welding process and welding position used. Each welder shall be assigned an

identifying symbol or mark and all shop and field welded connections containing complete or partial joint penetration welds, multi-pass fillet welds, and fillet welds greater than 5/16" shall be identified by the symbol or mark of the welder responsible for the connection.

C. Minimum Size and Strength:

1. Fillet Welds: Minimum size of fillet welds shall be as specified in Table J2.4 in AISC Specification, Chapter J.

2. Partial-Penetration Groove Welds: The minimum effective throat thickness of partial-penetration groove welds shall be as specified in Table J2.1 in AISC Specification, Chapter J.

3. Minimum Strength of Welded Connections: Except as specified below in "Connections" or noted otherwise on the drawings, all shop and field welds shall develop the full tensile strength of the member or element joined. All members with moment connections as indicated on the drawings shall be welded to develop the full flexural capacity of the member, unless noted otherwise on the drawings.

D. Filler Metal Requirements: Weld metal shall be as specified in Table J2.5 in AISC Specification, Chapter J and other requirements of this specification.

E. Welding Procedure Specification:

1. All welding shall be performed in accordance with a Welding Procedure Specification (WPS) as required in AWS D1.1 and approved by the Design Professional's Testing Laboratory and the Design Professional. The WPS variables shall be within the parameters established by the filler-metal manufacturer. Engage the services of an independent testing laboratory to provide the qualification testing required by AWS D 1.1, chapter 4, part B to qualify any non-prequalified WPS needed for the project. The testing laboratory shall prepare Welding Procedure Qualification Records (WPQR) documenting the successful qualification of each Welding Procedure Specification.

2. Welding Procedure Specifications for welds designated as Demand Critical Welds shall additionally comply with the requirements of ANSI/AWS D1.8, Paragraph 6.1.

F. Welding Procedures:

1. All welding processes shall comply with the requirements of ANSI/AWS D1.1 unless noted otherwise.

2. Welding processes for welds that are a part of the Seismic Load Resisting System shall additionally comply with the requirements of ANSI/AWS D1.8, chapter 6.

3. Built-up sections assembled by welding shall be free of warpage and all axes shall have true alignment.

4. Welds not specified shall, if possible, be continuous fillet welds developing the minimum strength, as specified above, using not less than the minimum fillet welds as specified by AISC.

5. The toughness and notch sensitivity of the steel shall be considered in the formation of all welding procedures to prevent brittle and premature fracture during fabrication and erection.

6. Before welding is started, the fabricator shall submit for the approval of the Design Professional's Testing Laboratory in consultation with the Design Professional, written Welding Procedure Specification for all joints to be welded. After approval, the Welding Procedure Specification shall be followed without deviation unless specific approval for change is obtained from the Design Professional's Testing Laboratory and the Design Professional.

7. Before welding, particular attention shall be paid to surface preparation, fit up and cleanliness of surfaces to be welded.

8. Minimum preheat and interpass temperatures for structural steel welding shall be as specified in ANSI/AWS D1.1, except that no welding shall be performed when the ambient temperature is lower than 0 degrees F. The temperature shall be measured from the side opposite that upon which the preheat is applied.

9. The heat, input, length of weld and sequence of weld shall be controlled to prevent distortions. The surfaces to be welded and the filler metals to be used shall be subject to inspection before any welding is performed.

10. Welds shall be sound throughout. There shall be no crack in any weld or weld pass. Welds shall be considered sound if they conform to AWS requirements, as confirmed by non-destructive testing.

11. Welds shall be free from overlap.

12. Craters shall be filled to the full cross section of the welds.

13. For high-strength low-alloy steels, follow welding procedures as recommended by steel producer for exposed and concealed connections.

14. Fabricator and erector shall coordinate welding responsibility at all welded joints.

2.4 BOLTING

A. Bolt Diameter: Minimum bolt diameter shall be 3/4 inch. The difference in diameter between bolts of differing sizes used on the project shall be not less than ¼".

B. Connection Type: Unless noted otherwise on the drawings, all bolted connections shall be snug-tightened using high-strength bolts in standard holes (hole diameter nominally 1/16 inch greater than the nominal bolt diameter) with threads included in the shear planes. Notwithstanding, the contractor shall be responsible to adhere to provisions of AISC Specification Section J1.10, which lists circumstances under which certain connections require pretensioned high strength bolts.

C. Oversize, Short Slotted and Long Slotted Holes: The dimensions and washer requirements of oversize, short slotted, and long slotted holes shall conform to the AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

D. Fastener Tension:

1. High strength bolts in snug-tightened joints shall be tightened to a snug tight condition only. Do not pretension bolts in snug-tightened joints the same as if they were in slip-critical joints. The snug-tightened condition is defined as the tightness that exists when all plies are in firm contact. This may usually be attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench.

2. High-strength Bolts in Slip-critical and Pretensioned Joints:

   a. High-strength bolts in slip-critical and pretensioned joints shall be tightened to achieve the minimum bolt tension as specified in the AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts" when all the fasteners of a joint are tight. A Class A faying surface shall be provided at all slip critical joints.
   b. Any of the four methods to tighten bolts specified in the AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts" may be used to achieve the minimum bolt tension. The tightening procedure that uses direct tension indicator washers shall conform to the requirements of ASTM F959.

E. The Contractor shall cooperate with the Design Professional's Testing Laboratory when Arbitration Testing and Inspection is called for due to a disagreement regarding the tension in installed bolts that have been inspected according to the Structural Testing Laboratory Services Specification.Washers: Washers under the bolt head and/or nut shall be used as required by the AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

F. Bolt Lubrication: All bolts shall be well lubricated at time of installation. Dry, rusty bolts will not be allowed.

G. Impact Wrenches: Properly sized and lubricated air impact wrenches with adequate air pressure shall be utilized for all bolt installation.

H. New Bolts: All bolts shall be new and shall not be reused.

2.5 CONNECTIONS

A. Conceptual connection details with the required member design forces are shown on the drawings for bidding purposes and are applicable to all connections not designed and completely detailed on the drawings. The conceptual details are provided only to indicate the connection type required and may not fully represent the complexity of the connection as required by the final connection design for the forces they must resist. Except as noted below, the fabricator is responsible for engaging the services of a connection specialty engineer to prepare a final connection design for submission that meets the requirements of the conceptual connection details and resists the indicated design forces. Refer to the drawings and specifications for complete requirements. By bidding this project, the fabricator acknowledges that additional connection elements may not be specifically shown in the conceptual details but may be required by the final connection design, such as stiffener plates, doubler plates, supplement/reinforcing plates or other connection material. The fabricator is responsible to include within his bid all material and labor required to conform to the intent of the conceptual details and to carry the design forces indicated, regardless of whether or not all connection elements (such as stiffener plates, doubler plates, supplement/reinforcing plates or any other connection material) required by final connection design are shown in the conceptual detail. Design and Detailing Procedure:

1. Unless noted otherwise or specifically detailed on the drawings, end connections of beams, girders, and trusses shall be designed as flexible and the connection shall accommodate end rotations of the unrestrained beams. Restrained end connections, as indicated on the drawings, shall be designed for the combined effect of bending moment and shears induced by the rigidity of the connection. Forces to be used in the design are described below.

2. The fabricator's licensed professional engineer shall design and submit sealed calculations documenting the design and showing details of the assembled joint with the bolts and welds required for the conditions noted below:

   a. For each connection not otherwise completely detailed on the drawings

b. Where connections are of the type that would normally be selected or completed using information found in tables in the AISC "Steel Construction Manual" or related publications but where conditions are encountered on the project that do not match those assumed in the AISC Manual or other similar publication.

3. Where connections are of the type than can be selected or completed using information found in tables in the AISC "Steel Construction Manual" or related publications, sealed calculations need not be submitted provided the project design conditions precisely match those assumed in the referenced publications. For conditions encountered on the project that do not conform to the AISC Manual or other similar publication, a complete design shall be prepared and submitted for Design Professional's review.

4. The fabricator's licensed professional engineer shall seal all design calculations.

5. The Design Professional the right to reject all shop drawings submitted without complete design calculations if required. Failure to adhere to the requirements of this section obligates the Contractor to take responsibility for any and all resulting delays in the detailing and fabrication of structural steel.

B. Design Intent: It is the intention of the plans and specifications that shop connections be welded or bolted and that field connections be bolted, unless detailed otherwise on the drawings.

C. Preliminary Connection Review: The fabricator shall submit preliminary details of proposed typical connections for Design Professional's review not less than 14 days prior to the start of preparation of detailed shop drawings. Proposed variations from the details shown on the drawings will be considered and such variations must obtain preliminary approval from the Design Professional prior to preparation of detailed shop drawings.

D. Flexible (Simple) Beam Connections:

1. All typical beam simple connections shall conform to requirements of the AISC specifications. Refer to the drawings for typical connection types.

2. Seated Beam Connections and Stiffened Seated Beam Connections shall not be used unless indicated on the drawings or unless Design Professional approval is obtained to verify capacity of supporting member for the resulting eccentricity. The fabricator must verify and bear responsibility that the use of such connections does not interfere with architectural or MEP requirements.

3. Simple Beam Connection Capacity: Support a factored load reaction R equal to the reaction shown on the plans. Contact the Design Professional if no reaction for a beam is shown on the plan. Each connection shall contain not less than the minimum number of bolts shown in the AISC connection tables for each beam size.

E. Restrained (Moment) Connections:

1. Refer to the drawings for Moment Connection Details.

2. Design Reactions for Moment Connected Beams: Shear connections for moment-connected beams shall be designed for the factored reaction shown on the drawings.

3. Design and Furnishing of Reinforcement in Moment Connected Joints: As part of the design responsibility outlined above, the fabricator shall design and furnish all additional reinforcement in moment connected joints to resist the specified design forces unless otherwise specifically detailed on the drawings. Column sections shall be investigated

for web shear, web yielding, web buckling, and tension. Stiffeners and/or doubler plates shall be furnished as required by the AISC Specification Section K1.

F. Tightening of Bolts in Welded Moment Connections. At moment connections where beams are complete-joint penetration welded directly to columns or girders in the field, welds shall be made after installation of erection bolts to draw the pieces together and before the final shear connection bolts are tightened. Where loose moment plates are used, such plates shall be groove welded to columns prior to connecting these plates to the beams.

G. The geometry and welding process for complete-joint-penetration-welded-moment connections in Seismic Load Resisting Systems shall comply with the requirements of ANSI/AWS D1.8, chapter 6 and the groove welds of those connections are Demand Critical Welds.

H. Column Splices:

1. Compression Splice: Unless indicated otherwise on the drawings all column splices shall be either a bolted compression splice using high strength snug-tightened bolts or a welded compression splice. Splice and filler plate sizes, thicknesses, and number of fasteners or weld information shall be as shown in Table 14-3 of AISC "Steel Construction Manual". It shall be the fabricator's responsibility to examine the architectural drawings to verify that splice plates and fasteners do not violate architectural finish requirements.

2. A complete-joint penetration welded column splice for a column that is a part of the Seismic Load Resisting System is a Demand Critical Weld.

3. Remove weld tabs from complete-joint-penetration-weld column splices in Seismic Load Resisting Systems.

4. Bearing and Fit-Up of Column Compression Joints: All column splices, except those that are direct welded with complete-joint penetration welds, shall be considered as a compression joint as defined herein unless noted otherwise on the drawings.

I. Base Plates and Bearing Plates:

1. Finish: All baseplates and bearing plates shall be finished in accordance with AISC Specification M2.8.

2. Attachment to Column: Unless shown otherwise on the drawings, all baseplates and bearing plates shall be welded all around to the column with minimum fillet welds as specified in AISC Specification Table J2.4.

3. A complete-joint penetration weld that joins a column that is a part of the Seismic Load Resisting System to a base is a Demand Critical Weld.

4. Anchor Rod Holes in Baseplates: Hole sizes in baseplates for anchor rods shall be made oversize as described in the AISC "Steel Construction Manual", Table 14-2.

J. Hangers and Braces:

1. Connections for all hangers and braces shall have connections designed to develop the factored axial force shown on the drawings. Contact the Design Professional if no force for a member is shown on the drawings.

2. Compression members composed of two or more rolled shapes separated from one another by intermittent fillers shall be connected to one another at such fillers at intervals (not to exceed 48") so that the slenderness ratio l/r of either shape, between the fasteners, does not exceed 75% of the governing slenderness ratio of the built-up member. The least radius of gyration, r, shall be used in computing the slenderness ratio of each component part.

K. Stiffeners: Provide stiffeners finished to bear under load concentrations where shown on the drawings.

L. Steel Shelf Angles: Shelf angles supporting veneer shown on the drawings to be continuous shall be furnished to a maximum length of 25'-0". Provide a 1/4" gap at each joint. The gap shall not be welded. The distance from the joint to the first supporting bolt shall not exceed 40% of the bolt spacing. Shelf angles shall be continuous around corners with corner joint complete-joint penetration welded.

M. Limitations on Use of A307 Bolts: ASTM A307 bolts shall not be used in any permanent steel-to-steel or concrete–to-steel connection.

N. Bolts in Combination with Welds: Bolts shall not be considered as sharing the load in combination with welds, except as allowed in AISC Specification Section J1.8.

2.6 SURFACE PREPARATION AND SHOP PRIME PAINTING

A. Specification: Surface preparation, paint, and painting practices shall conform to the "SSPC Painting Manual", Volumes 1 and 2.

B. Scope: All steel shall remain unpainted, except the following:

1. Shop paint surfaces that are to remain exposed to view in the final construction.

2. Shop paint any steel other than weathering steel that, in the final construction, will not be in a controlled environment and is therefore subject to moisture or high humidity infiltration and that has not been specified to be galvanized.

3. Shop paint any steel that is shown on the drawings to receive a finished paint system as defined in Specification Section 09 90 00.

4. Coordinate all shop painting of structural steel with Architect's painting requirements as specified on the architectural drawings and in the specifications. The Fabricator shall be responsible for determining all painting requirements (which surfaces are to be painted or left unpainted) on the project prior to fabrication.

C. Additional Painting Requirements

1. Extend shop paint to 2" from location of welds on surfaces that are to be field welded.

2. All unpainted mating surfaces of all elements that are welded together into an assembly that is permanently exposed to the exterior shall be seal welded in addition to structural welding requirements.

3. If individual elements (including the mating surfaces) of an assembly that is required to be painted are painted prior to welding into an assembly, then all painted surfaces affected by welding shall be touched-up and repaired (according to manufacturer's instructions, if any) to prevent corrosion bleeding.

4. The fabricator shall be responsible to ensure that all elements of all assemblies that are to be painted are fabricated so that no exposed surface shall be subject to stains due to corrosion bleeding during the warranty period of the paint.

D. Surface Preparation - Unpainted Steel: All structural steel that is not specified to receive a shop coat of primer paint shall be prepared in accordance with Society for Protective Coatings specifications as follows:

1. SSPC-SP 2, "Hand Tool Cleaning" or SSPC-SP 3, "Power Tool Cleaning" unless otherwise specified.

E. Surface Preparation and Primer Paint - Shop Painted Steel:

1. Surface Preparation: Prepare the surface of all structural steel specified to be shop painted as required by the paint manufacturer or the Society for Protective Coatings specifications, but not less than the following:

   a. SSPC-SP 2, "Hand Tool Cleaning" or SSPC-SP 3, "Power Tool Cleaning" unless otherwise specified.

2. Priming: Immediately after surface preparation, apply primer to all structural steel specified to be shop primed in strict accordance with manufacturer's instructions and the Society for Protective Coatings specifications. Apply paint at a rate to conform to the manufacturer's written instructions and to provide a dry film thickness of not less the 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, welds, and all exposed surfaces. Apply two coats to surfaces that are inaccessible after assembly or erection. Change the color of the second coat to distinguish it from the first coat.

3. Finish Coat: Coordinate shop primer paint requirements with architectural drawings and specifications. The primer selected must be compatible with any specified finish coat.

F. Shop Touch-Up Painting: The Fabricator shall provide for cleaning and touch-up painting of welds, bolted connections (including nuts, bolts, washers, filler plates, member end supplement plates and welds, if any), and abraded areas. Prior to shipment, apply paint to exposed areas using same materials and surface preparation as used for shop painting. Paint shall be applied by brush or spray with minimum dry film thickness of 1.5 mils.

PART 3 - EXECUTION

3.1 ERECTION

A. The Erection work shall comply with the requirements of AISC Specification Section M4.

B. Inspection: Erector shall examine areas and conditions under which structural steel work is to be installed and notify the Contractor and the Design Professional in writing of conditions detrimental to proper and timely completion of the work.

C. Surveys: The following surveys shall be performed.

1. Initial Survey: Check elevations of concrete and masonry bearing surfaces and anchor bolt locations prior to erection and submit any discrepancies to the Design Professional prior to the start of erection. Corrections or compensating adjustments to the structural steel shall be made and approved prior to the start of erection.

2. Final Survey: Upon completion of erection of the steel frame, and before the start of work by other trades that may be supported, attached, or applied to the frame, a final survey shall be made and a report submitted certifying compliance with specified tolerances.

D. Erection Tolerances: Erection tolerances of anchor rods, embedded items, and all structural steel shall conform to the AISC Code of Standard Practice, Section 7, unless stricter tolerances are specified elsewhere in the contract documents.

E. Temporary Shoring and Bracing:

1. The lateral-load resisting or stability-providing system and connecting diaphragms are identified on the drawings. Comply with the provisions of the Code of Standard Practice regarding stability of the structure during the erection process, except where stricter requirements are noted herein.

2. Where architectural or MEP requirements do not allow for any temporary supports, members, erection devices, or connections to be left in place permanently or where such items affect the final structural behavior, they shall be removed by the erector. All costs associated therewith shall be included in the bid price.

F. Anchor Rods: Furnish anchor rods and other connectors required for securing structural steel to foundations and other in-place work. Furnish 1/8" minimum steel templates for presetting bolts and other anchors to accurate locations. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout. Use only steel wedges or shims.

G. Base Plates and Bearing Plates: Remove loose latent material from bearing surfaces and base and bearing plates. Set plates to the elevation indicated on the drawings and level using steel shims (plastic shims will not be allowed) or by three leveling screws with weldments at the plate edges. After all protruding plates have been trimmed, grout plates solidly between bearing surfaces using the specified grout, ensuring no voids are present. Finish exposed surfaces, protect installed materials, and allow to wet cure. For proprietary grout materials, comply with manufacturer's instructions. Tighten anchor bolts after supported members have been positioned and plumbed.

H. Splices: Splices will be permitted only where indicated on the contract drawings and approved shop drawings. Fastenings of splices of compression members shall be done after the abutting surfaces have been brought completely into contact within AISC tolerances. Bearing surfaces and surfaces that will be in permanent contact are to be cleaned before the members are assembled.

I. Field Modifications to Structural Steel: Errors in shop fabrication or deformation resulting from handling and transportation that prevent the proper assembly and structural fitting of parts shall be reported immediately to the Design Professional, and approval of the method of correction shall be obtained. Approved corrections shall be made at no additional cost to the Owner. Do not use cutting torches, reamers, or other devices in the field for unauthorized correction of fabrication errors.

J. Miscellaneous Framing: Provide supplemental structural steel support framing for metal deck where columns, or other framing members or floor openings interrupt normal deck bearing whether shown or not on the architectural, mechanical, or structural drawings.

K. Removal of Erection Aids and Devices: The erector shall remove all erection aids and devices that interfere with architectural finish or MEP requirements.

L. Field Touch-Up Painting:

1. Clean field welds, unpainted areas of bolted connections (including all exposed areas of nuts, bolts, washers, filler plates, member end supplement plates, and welds), and any shop painted areas that are abraded. Apply paint to all exposed areas using same material and surface preparation as used for shop painting. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

2. Clean field welds, ungalvanized areas of bolted connections (including all exposed areas of nuts, bolts, washers, filler plates, member end supplement plates, and welds), and any galvanized areas that are abraded. Prepare surfaces and apply specified galvanizing repair paint in accordance with ASTM A780.

3. The Contractor shall ensure that, at the substantial completion of the project, all structural steel, bolted and/or welded, required to be painted shall have all necessary steel surfaces painted (including touch-up painting as required) to prevent corrosion bleeding.

M. Clean Up: Clean up all debris caused by the Work of this Section, keeping the premises neat and clean at all times.

3.2 QUALITY ASSURANCE TESTING AND INSPECTION DURING CONSTRUCTION

A. See Testing Laboratory Services section of these Specifications for structural steel materials and welding and bolting inspection and test requirements.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 05 1213

ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Comply with the requirements of section 05 12 00 – "Structural Steel Framing" unless otherwise modified in this section.

1.2 DESCRIPTION OF WORK

A. Extent of architectural structural steel work is shown on drawings.

B. Architecturally exposed structural steel is referred to herein and on the drawings as AESS.

1.3 QUALIFICATIONS

A. Fabricator:

The structural steel fabricator shall have not less than 5 years experience in the successful fabrication of architecturally exposed structural steel similar to this project.

The structural steel fabricator must participate in the AISC Quality Certification Program and be designated an AISC Certified Plant in Steel Building Structures.

B. Erector:

The structural steel erector shall have not less than 5 years successful experience in the erection of architecturally exposed structural steel of a similar nature to this project. Evidence of compliance with this section shall be submitted to the Design Professional.

1.4 SUBMITTALS

A. Samples: Submit samples of architecturally exposed structural steel that are labeled to indicate the product, characteristics and locations in the Work. Furnish samples that show each type of weld in 8" lengths, and the surface cleaning, shop primer and finish required for the Work. The samples will be review for appearance only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

B. Mock-ups: Prior to installing architecturally exposed structural steel, construct mockups for each form of construction and finish required to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.

1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by the Design Professional.

2. Notify Design Professional one week in advance of the dates and times when mockups will be constructed.

3. Demonstrate the proposed range of aesthetic effect and workmanship of steel surfaces and welded and bolted connections.

   a. Coordinate finish-painting requirements of mockups with Division 9 Section "Painting."

4. Obtain Design Professional's approval of mockups before start of final unit of Work.

5. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

   a. When directed, demolish and remove mockups from Project site.
   b. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

PART 2 - PRODUCTS

2.1 PRODUCT

A. Repair Filler for Architecturally Exposed Structural Steel: Solvent-resistant, 2-component metal and epoxy compound suitable for repair of steel. The following products are acceptable.

1. "Scotch-Weld Adhesive 1751", 3M Company

2. "Plastic Steel", Devcon Corporation

3. "Magic 4 Minute epoxy", Epoxy Industries LTD

2.2 FABRICATION

A. Fabricate architecturally exposed structural steel with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.

1. Remove any remaining pockets, voids, pitting or other blemishes by filling with repair filler, grinding, or by welding and grinding, prior to cleaning, trading, and shop priming.

2. All exposed edges and ends of plates or bars must be square and smooth, free of cutting marks, shear distortion, burrs, and nicks.

3. Provide uniform and consistent joints with all exposed copes, miters and butt cuts.

4. Do not apply permanent mill markings, erection marks, symbols, or painted notes to exposed surfaces.

5. Select weld sizes, sequence, and equipment so as to limit distortions to within allowable tolerances. "Print thru" of back-side welding to exposed surfaces or "dimpling" will not be acceptable. Continuously weld joints in architecturally exposed structural steel members. The welds shall be ground and/or otherwise treated as required to blend with adjacent parent metal.

6. Where flush butt joints are required, welds shall be slightly oversized and ground flat, or slightly undersized, filled with plastic filler and ground flat.

7. Grind exposed fillet welds smooth that are 1/2" and larger. Cover fillet welds with a smooth application of plastic filler.

8. Areas where studs are to be attached shall be clean and free of mill scale or foreign material.

B. Dimensional Tolerances: Dimensional tolerances of fabricated structural steel shall conform to Section 10 of the AISC Code of Standard Practice unless specified otherwise.

2.3 CONNECTIONS

A. Preliminary Connection Review: The fabricator shall submit details of proposed typical connections for Design Professional review prior to preparation of detailed shop drawings. Proposed variations in details shown on the drawings shall be considered and such variations must obtain preliminary approval prior to preparation of detailed shop drawings.

PART 3 - EXECUTION

3.1 ERECTION

A. General: Conform to the requirements of Chapter 10 of the AISC Code of Standard Practice, except as otherwise indicated.

B. Protection: Take care to prevent damage or blemishes due to temporary braces, erection clips, or hoisting procedures.

C. Erection Tolerances: Comply with all erection tolerances of the AISC Code of Standard Practice for AESS and as supplemented below:

1. Architecturally exposed steel with windows and/or other architectural infills in the same plane:

   a. Vertical opening dimensions ± 1:750
   b. Horizontal opening dimensions ± 1:750
   c. Variation from plane (flatness) ± 1:1000
   d. Variation of perimeter columns from longitudinal axis (in floor to floor height) 1:750
   e. Maximum variation from flushness of adjoining members 1/16"

2. Architecturally exposed steel in form of open portals or framing with out-of-plane infills may have permissible deviations as recommended for erection of structural steel by AISC Code of Standard Practice.

D. Field Assembly of Structural Steel: On exposed welded construction, remove erection bolts, fill holes with plug welds or plastic filler and grind smooth at exposed surfaces. Grind all butt and plug welds projecting more than 1/16" above the exposed surfaces and all tack welds. Remove all weld splatter. Repair all welds structurally defective and that are not reasonably smooth and uniform.

E. Welded Connections: Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 05 2100

STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE OF WORK

A. Extent of steel joists is shown on drawings, including basic layout and type of joists required.

B. Quantity of joists required shall be determined from the contract drawings.

1.3 QUALITY ASSURANCE

The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

Qualifications:

A. The steel joist manufacturer shall be a firm experienced in manufacturing joists similar to those indicated for this Project and with a record of successful in-service performance for a minimum of 2 years.

B. The steel joist manufacturer must show evidence of compliance with the submittal, testing, and inspection requirements of the Steel Joist Institute (SJI) Standard Specifications for verification of design and manufacturing.

C. Design and Manufacturing: Provide joists designed and manufactured in compliance with the following, and as herein specified.

1. Steel Joist Institute (SJI) Standard Specifications, Load Tables and Weight Tables for K and LH/DLH Series Steel Joists and Joist Girders, latest edition.

2. Recommended Code of Standard Practice for Steel Joists and Joist Girders, latest edition.

3. SJI Technical Digest #8 "Welding of Open Web Steel Joists"

4. Comply with all OSHA requirements.

D. Qualification of Field Welding: Qualify field welding processes and welding operators in accordance with American Welding Society (AWS) qualification procedure.

1.4 SUBMITTALS

A. Qualification Data: Submit evidence of compliance with the requirements listed in section 1.03 A and B.

B. Shop Drawings:

1. Submit detailed drawings showing layout of joist units, connections, jointing and accessories. Include length, camber, mark, number, type, location and spacing of joists and bridging. Submit details for member splices.

2. Provide templates or location drawings for installation of anchorage devices and bearing plates in other construction materials.

C. Design Calculations: Submit design calculations for all joists showing complete geometry and member sizes, including web and chord member splices to verify compliance with these specifications, contract drawings, and SJI specifications. Calculations shall be signed and sealed by a licensed engineer in the state where the project is located.

D. Mill Certificates: Submit mill reports for the structural steel used in the joists and for the bolts certifying compliance with specified requirements.

E. Certificate of Compliance: Submit certificate of compliance to Design Professional certifying that manufacturing work was done in accordance with approved construction documents and with SJI Standard Specifications.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle steel joists as recommended in SJI specifications. Handle and store these in a manner to avoid deforming members and to avoid excessive stresses.

1.6 SHOP INSPECTION

A. The manufacturer's quality assurance inspector shall inspect joists before shipment to insure compliance of materials and workmanship with the documents specified in this specification. Repair any defects found prior to shipment of the joists.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI specifications for chord and web members

B. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular hexagon type, low carbon steel.

C. High-Strength Threaded Fasteners: ASTM A 325 heavy hexagon structural bolts with nuts and hardened washers.

D. Steel Prime Paint: Comply with SJI specifications.

E. Welding Electrodes: Comply with AWS standards.

2.2 FABRICATION

A. General: Fabricate steel joists in accordance with all documents listed in "Quality Assurance", except as noted below.

B. Splices in Chord Members: All splices shall be designed and provided in accordance with SJI Specifications. The splices in each of the two angles or bars of all members shall not be at the same location, but shall be staggered a minimum of 6 inches.

C. Holes in Chord Members: Provide holes in chord members where shown in contract drawings for securing other work to steel joists; however, deduct area of holes from the area of chord when calculating strength of member.

D. Joists shall be cambered for dead loads: Provide all joists with SJI standard camber unless specified otherwise on the drawings. Review the Structural Drawings and Specifications for information concerning dead loads for joists requiring other than standard camber. Joist camber must be shown on shop drawings submitted for review. Not showing camber information on shop drawings shall be cause for rejection of shop drawings.

E. Joist Bearing: Provide minimum end bearing of joists as required by SJI specifications but subject to requirements below: Provide sloped shoes if joist slope exceeds ¼ inch per 12 inches (1:48).

1. Joists Less than 60-Foot Span:

a. If two joists do not abut each other at a support, provide required joist bearing centered on the supporting member unless detailed otherwise on the drawings.
b. If two joists abut each other at a support and sufficient minimum bearing for each joist exists, provide 1/4" space between joist ends centered over the support unless detailed otherwise on the drawings.
c. If two joists abut each other at a support and sufficient minimum bearing for each joist does not exist at the support, offset the ends of each joist
d. and center joist bearing on the center of the support.

F. Top Chord Extensions and Extended Ends: Provide top chord extensions and extended ends on joists where shown in contract drawings complying with the requirements of SJI specification and load tables.

G. Ceiling Extensions: Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit, to suit manufacturer's standards, of sufficient strength to support ceiling construction. Extend ends to within 1/2" of finished wall surface unless otherwise indicated.

H. Bridging: Provide horizontal and/or diagonal type bridging for all joists, complying with SJI specifications at a minimum.

1. Examine the drawings carefully for special bridging requirements such as may be required to resist net uplift forces as shown on the drawings or to provide special bracing.

2. Provide bridging anchors for ends of bridging lines terminating at walls or beams.

I. End Anchorage: Provide end anchorages to secure joists to adjacent construction, complying with SJI specifications, unless otherwise indicated.

J. Header Units: Any situation requiring heading of joists not shown on the structural drawings shall be referred to Design Professional for framing.

K. Shop Painting: Remove loose scale, heavy rust, grease, oil and other foreign materials from fabricated joists and accessories by rotary wire brushes and/or solvents before application of shop paint.

Apply one shop coat of primer paint to steel joists and accessories, by spray, dipping, or other method to provide a continuous dry paint film thickness of not less than 0.50 mil.

PART 3 - EXECUTION

3.1 ERECTION

A. Place and secure steel joists strictly in accordance with SJI code of standard practice, SJI specifications, final shop drawings, and as herein specified.

B. Placing Joists: Do not start placement of steel joists until supporting work is in place and secured. Place joists on supporting work, adjust and align in accurate locations and spacing before permanently fastening.

1. Comply with SJI specifications regarding required bridging, connections, and anchors to ensure lateral stability during construction. Remove as required for architectural, structural, and mechanical clearances after erection.

2. Where members support joists from both sides and the supporting width does not meet the SJI recommendations for bearing lengths of both joists, the joists shall be offset to provide recommended bearing lengths. Such offsets shall be subject to approval by the Design Professional.

C. Bridging: Install bridging simultaneously with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.

3.2 ANCHORING JOISTS

A. Anchor steel joists to supporting steel framework with welds, bolts, or a combination of the two in accordance with SJI specifications for type of joists used. Joists on column lines shall be field bolted with high-strength threaded fasteners installed snug tight.

B. Joists where shown with bottom chord extensions shall not have the bottom chords connected to the supporting members until the full dead load is applied.

C. Anchor joists resting on masonry or concrete to steel bearing plates embedded therein with welds, bolts, or a combination of the two in accordance with SJI specifications for type of joists used.

D. Touch-Up Painting: After joist installation, paint field bolt heads and nuts, welded areas, and abraded or rusty surfaces on joists and steel supporting members. Wire brush surfaces and clean with solvent before painting. Use same type of paint as used for shop painting.

3.3 ATTACHMENTS TO JOISTS

A. The Contractor shall ensure that no cuts or holes are made in the members of the erected joists for attachment of ceiling, ducts, pipes, or any other items not specifically shown in the contract drawings. Use of power driven fasteners in the diagonal and bottom chord members of the joists is prohibited.

B. The Contractor shall not hang any elements from the top or bottom chords of joists except ceiling, ducts, pipes or other items specifically shown on the Contract Documents, without the written authorization of the Design Professional.

1. All pipes, ducts, and other mechanical, electrical, and plumbing equipment suspended from the joists' top or bottom chord and producing hanger loads exceeding 60 pounds shall have the hanger attached at a joist panel point only except if the chord member is stiffened according to the typical detail shown on the drawings.

2. All ceilings hung from the joists and producing a concentrated load of 60 pounds or less may have the grid hung anywhere along the bottom chord. Hung ceilings producing more than a 60 pound concentrated load shall have the grid hung only at joist panel points except if the chord member is stiffened according to the typical detail shown on the drawings.

3. Heavy pipes, ducts, or other equipment hung from joists may require additional reinforcement and shall be referred to the **Design Professional** for framing.

3.4 QUALITY ASSURANCE TESTING AND INSPECTION DURING FABRICATION AND ERECTION

A. See Testing Laboratory Services section of these Specifications for open web steel joist inspection and testing requirements.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 05 3123

STEEL ROOF DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 - Specification sections, apply to work of this section.

1.2 SCOPE OF WORK

A. Supplier: The steel deck supplier shall furnish all steel deck materials and accessories indicated on the Architectural, Structural, and Mechanical Drawings required to produce a complete job including but not necessarily limited to deck units, cover plates, steel deck edge closures, cell closures, cant strips, sump pans, and all related accessories.

B. Erector: The Subcontractor responsible for erecting the steel deck shall provide all labor and equipment as required to place all steel deck components and accessories as described above.

1.3 QUALIFICATIONS

A. The steel deck supplier shall be a manufacturer with a minimum of two years successful experience and with a minimum of two successful jobs of a comparable size and scope to this project.

1.4 QUALITY ASSURANCE

The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

A. Codes and Standards: Comply with provisions of the following codes and standards except as otherwise indicated or specified:

1. "Design Manual for Composite Decks, Form Decks, and Roof Decks", as published by the Steel Deck Institute (SDI).

2. "Specification for the Design of Cold Formed Steel Structural Members", as published by the American Iron and Steel Institute (AISI).

3. "Structural Welding Code – Sheet Steel", D1.3 as published by the American Welding Society (AWS).

B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with AWS procedures.

1.5 SUBMITTALS

A. Product Certification: Submit manufacturer's specifications and installation instructions for each type of deck specified. Also submit a certificate of product compliance with SDI Standards as specified.

B. Shop Drawings: Submit detailed shop drawings showing type of deck, complete layout, attachment details, closures, edge strips, supplementary framing, and all other accessories.

C. Insurance Certification: Assist Design Professional and Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire, windstorm, and extended coverage insurance.

D. Welding Certificates: Submit Copies of certificates for welding procedures and personnel.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. See General Notes on the drawings for the location, depth, design thickness, and design section properties for all required roof decks.

B. Acceptable manufacturers include:

ASC Steel Deck.
Canam Group.
Consolidated Systems, Inc.
Cordeck
Epic Metals Corp.
Loadmasters Systems, Inc.
Marylyn Steel Decks, Inc.
New Millennium Building Systems, Inc.
United Steel Deck, Inc.
Valley Joist, Inc.
Verco Manufacturing Co.
Vulcraft/Div. Nucor Corp.
Wheeling Corrugating Co.

2.2 GRADES OF STEEL

A. Steel deck shall be manufactured from steel conforming to A653, Structural Steel Grade for galvanized deck, having a minimum yield strength of 33,000 PSI.

2.3 FINISH

A. Galvanizing: Steel deck shall be galvanized with a protective zinc coating conforming to ASTM A653 G90.

B. Galvanizing Repair Paint: High zinc-dust content paint for repair of damaged galvanized surfaces complying with Department of Defense Specifications DOD-P-21035.

2.4 ROOF DECK ACCESSORIES

A. Provide minimum 20 gauge ridge and valley plates, minimum 20 gauge cant strips, minimum 14 gauge sump pans, minimum 20 gauge inside or outside closure channels angles or plates, minimum 20 gauge butt strips at change of deck directions, minimum 20 gauge filler sheets, and rubber closures as required to provide a finished surface for the application of insulation and roofing.

2.5 MECHANICAL FASTENERS

A. Self-Drilling Screw Fasteners: Provide corrosion-resistant, hexagonal head, steel self drilling screws, austempered to a core hardness of Rockwell C 50.

Provide products of one of the following manufacturers:

ITWBuildex
Grabber Construction Products
SFS Intec Fastening Systems, Inc., Wyomissing
Textron Fastening Systems

2.6 SIDE-LAP FASTENERS:

A. Provide Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

2.7 FABRICATION

A. General: Fabricate deck panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck", in SDI Publication No. 31, and the following.

B. Steel Deck Spans: Where possible, all steel deck shall extend over three or more supports. Single span deck is prohibited.

2.8 ROOF OPENINGS

A. Provide a 20 gage galvanized flat plate to reinforce openings in roof deck that are greater than 6" and less than 10" in any one direction.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install deck units and accessories in accordance with manufacturers recommendations and approved shop drawings, and as specified herein:

1. Place deck units on supporting framework and adjust to final position with accurately aligned side laps and ends bearing 2" minimum on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks. Place the end joint over a chord angle for deck bearing on steel bar joists.

2. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.

3. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.

4. Do not place deck units on concrete supporting structure until concrete has cured and is dry.

5. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.

6. Do not use roof deck units for storage or working platforms until permanently secured.

B. Attachment of Roof Deck:

1. The method of attachment, attachment pattern, and side lap fastener type and spacing shall be as shown on the drawings and comply with the requirements noted below.

2. Method of Attachment: The attachment method noted in the drawings shall comply with the applicable requirements below.

   a. Welding: Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work. Weld metal shall penetrate all layers of deck material at end laps and side joints and shall have good fusion to the supporting member. Welding washers shall be used only when welding steel deck less than 0.028" thickness. The diameter of the puddle weld on the supporting member shall be, at a minimum, the diameter stated in the drawings but no less than 1/2 inch.
   b. Self-Drilling Fasteners: Comply with the manufacturer's requirements to install the screws through all layers of the deck material and the manufacturer's required embedment into the supporting member.

3. Side Lap Fastening: Unless required otherwise by provisions of this specification, side laps of adjacent units shall be fastened by welding (on 20 gauge or heavier deck only) or#10 (min.) TEK screws so that spacing between supports and fasteners does not exceed the value prescribed on the drawings. Button Punching is not allowable as a side-lap fastener.

4. End Bearing: Provide a minimum end bearing of 2" over supports.

5. End Joints: End joints of sheets shall be lapped 2" minimum over supports. Decks that slope 1/4 inch or more in 12 inches in the long direction shall be erected beginning at the low side to insure that end laps are shingle fashion.

C. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking.

D. Reinforcement at Openings: Roof openings less than 6" square or diameter require no reinforcement. Openings 6" to 10" inclusive shall be reinforced with a 20 gauge galvanized plate welded to the deck at each corner and 6" maximum centers with a 5/8" diameter puddle weld or sheet metal screws. For openings greater than 10" in diameter or width, refer to the drawings and structural steel specifications for additional framing to support the deck around the opening.

E. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking and weld flanges to top of deck. Space welds not more than 12 inches apart with at least 1 weld in each corner.

F. Joint Covers: Provide steel joint covers at changes in direction of deck units, except where taped joints are specified.

G. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

H. Flexible Closure Strips: Install flexible rubber closure strips that seal the flutes of the deck when the deck cantilevers over an exterior beam and the flutes are exposed to weather and over

interior partitions where there is no ceiling present and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.2 TOUCH-UP PAINTING

A. After deck installation, wire brush, clean and paint scarred areas, welds and rust spots on top and bottom surfaces of decking units and supporting steel members.

B. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.

3.3 QUALITY ASSURANCE INSPECTION DURING CONSTRUCTION

A. The method of attaching the deck to the frame is subject to inspection by the Design Professional's designated Testing Laboratory. The Contractor shall, at its own expense, remove work found to be defective and replace with new acceptable work.

B. See Testing Laboratory Services of these Specifications for deck attachment inspection requirements.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 05 3140

STEEL COMPOSITE DECK

1.1 RELATED DOCUMENTS

Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 - Specification sections, apply to work of this section.

1.2 STANDARDS

The following Standards are listed in this specification:

ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

1.3 SCOPE OF WORK

A. Supplier: The metal deck supplier shall furnish all metal deck materials and accessories indicated on the Architectural, Structural, and Mechanical Drawings required to produce a complete job including but not necessarily limited to deck units, cover plates, pour stops, hanger slots or clips, metal deck edge closures, cell closures, and all related accessories.

B. Erector: The Subcontractor responsible for erecting the metal deck shall provide all labor and equipment as required to place all metal deck components and accessories as described above.

1.4 QUALIFICATIONS

The metal deck supplier shall be a manufacturer with a minimum of two years successful experience and with a minimum of two successful jobs of a comparable size and scope to this project.

1.5 QUALITY ASSURANCE

The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

A. Codes and Standards: Comply with provisions of the following codes and standards except as otherwise indicated or specified:

1. "Design Manual for Composite Decks, Form Decks, and Roof Decks", as published by the Steel Deck Institute (SDI).
2. "Specification for the Design of Cold Formed Steel Structural Members", as published by the American Iron and Steel Institute (AISI).
3. "Structural Welding Code – Sheet Steel", D1.3, as published by the American Welding Society (AWS).

B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with AWS procedures.

C. Underwriters Label: Provide metal deck units which are listed and conform to Underwriters Laboratories "Fire Resistance Directory", with each deck unit bearing the UL label and marking for specific system detailed.

1.6 SUBMITTALS

A. Product Certification: Submit manufacturer's specifications and installation instructions for each type of deck specified. Also submit a certificate of product compliance with SDI Standards as specified.

B. Shop Drawings: Submit detailed shop drawings showing type of deck, complete layout, attachment details, closures, edge strips, pans, deck openings, special jointing, supplementary framing, and all other accessories.

C. Calculations: If the submitted deck does not comply with the minimum properties shown on the drawings, the metal deck manufacturer shall submit design calculations sealed by a registered professional engineer in the state where the project is located verifying compliance with the specifications for all load and span conditions shown on the drawings.

D. Welding Certificates: Submit Copies of certificates for welding procedures and personnel.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

See the drawings for location of metal deck types and for depth of deck, design deck properties, design deck yield strength, concrete type, total slab thickness, slab reinforcing, and design superimposed loads. The average rib width to depth of deck ratio shall be greater than or equal to 2.0. The deck properties specified are the values used for the design of the deck shown on the drawings. The deck manufacturer shall be responsible for designing the deck if any one of the proposed deck properties other than depth are less than the minimum or design values stated. The design shall include the ability to carry the construction dead loads and design superimposed loads indicated for all the spans shown on the drawings and to meet all performance criteria as specified by the SDI. Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck".

Acceptable manufacturers include the following:

Canam Steel Corp.
Consolidated Systems, Inc.
DACS, Inc.
Marlyn Steel Decks, Inc.
United Steel Deck, Inc.
Valley Joist/Div. Ebsco Industries, Inc.
Verco Manufacturing Co.
Vulcraft/Div. Nucor Corp.
Wheeling Corrugating Co.

2.2 GRADE OF STEEL

Composite metal deck shall be cold formed from steel sheets conforming to ASTM A653, Structural Steel Grade, with a minimum yield strength of 40 ksi. The delivered thickness of the uncoated steel shall not be less than 95% of design thickness. Sheet metal accessories shall conform to the same material specification as the deck product.

2.3 FINISH

A. Galvanized: Composite metal deck shall be galvanized with a protective zinc coating conforming to ASTM A653 G60.

B. Galvanizing Repair Paint: High zinc-dust content paint for repair of damaged galvanized surfaces complying with Department of Defense Specifications DOD-P-21035.

2.4 RELATED PRODUCTS

A. Flexible Closure Strips: Provide manufacturers standard vulcanized closed cell, synthetic rubber.

B. Acoustic Sound Barrier Closures: Provide manufacturers standard mineral fiber closures.

2.5 FABRICATOR

A. Metal Deck Spans: The deck properties shown on the drawings are selected so that the spans do not exceed the maximum clear spans with unshored construction as required by SDI criteria unless indicated otherwise on the drawings. The deck manufacturer shall be responsible for supplying a deck that meets that criterion. Where possible, all metal deck shall extend over three or more spans. Simple span deck will not be permitted unless it is shored at midspan. Any additional concrete topping specified over the composite slab shall be placed after the slab has reached 75% of its design strength.

B. Metal Cover Plates - Cellular Deck: Fabricate metal cover plates for end abutting floor deck units of not less than same thickness as decking, formed to match contour of deck units.

C. Cell Closure at Ends of Metal Deck Flutes: Fabricate metal closure strips of not less than 0.0358" minimum (20 gage) cold formed sheet steel. Form to provide tight fitting cell closures at open ends of cells or flutes to prevent wet concrete from leaking through open cells.

D. Pour Stop Closures at Slab Edges: Provide sheet metal pour stop closures at all slab edges, columns, walls, and openings unless steel angles or bent plates are specified in details on the drawings. The closures shall be fabricated from light gage steel not less than the thickness shown in the table below when the slab edge is parallel to the deck span. Provide a return lip on the vertical leg in accordance with the SDI Design Manual. The overhang dimension is measured from the edge of the flange to the edge of the slab.

Overhang =	0"-2"	2"-4"	4"-6"	6"-8"	8"-10"
Slab Thickness					
5.25	18	16	14	12	10
6.25	16	14	12	12	10
6.5	16	14	12	12	10
8.0	12	12	10	10	NA

2.6 COMPOSITE SLAB REINFORCEMENT

See slab schedule on drawings for reinforcement in composite slabs.

2.7 OPENINGS IN METAL DECK

For unframed openings, provide blockout in slab for opening with deck uncut. Cut deck at opening after concrete has reached 75% of its design strength. See Section 3200, "Concrete

Reinforcement", for reinforcing in the slab around all unframed openings in metal deck that are greater than 10" in width in either direction.

2.8 CHLORIDE ADMIXTURES

The use of admixtures in concrete containing chloride salts shall not be permitted for metal deck concrete.

2.9 EXTRA CONCRETE REQUIRED BY DECK DEFLECTION

The General Contractor shall include in his bid additional concrete required for metal deck slabs to account for deck deflection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install deck units as accessories in accordance with manufacturers recommendations and approved shop drawings, and as specified herein:

1. Place deck units on supporting framework and adjust to final position with ends accurately aligned and bearing 1 1/2" minimum on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.
2. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.
3. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.
4. Do not place deck units on concrete supporting structure until concrete has cured and is dry.
5. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
6. Do not use floor deck units for storage or working platforms until permanently secured.

B. Attachment of Composite Deck:

1. Typical Welding of Deck: Metal deck units shall be welded to the structural support members with 5/8" ϕ puddle welds at each end of sheet and each intermediate support at each low flute, unless more frequent attachment is specified on the drawings. Where two deck units abut each other, each unit shall be so welded.
2. Side Laps: Unless noted otherwise on the drawings, side laps of adjacent units shall be fastened by welding (1-1/2 inch long), sheet metal screws (No. 10 or larger) or button punching at maximum intervals not exceeding the lesser of ½ of the span or 36".
3. Welding to Girder: Metal deck units shall be welded to girders (steel framing that is parallel to span of deck) with 5/8" ø puddle welds at 12" o.c. If the metal deck is not continuous across the girder, the deck on each side of the girder shall each be welded to the girder with 5/8" ø puddle welds at 12" o.c.
4. Welding Washers: Welding washers shall be used when welding steel deck units less than 0.028" thickness.
5. Welding of Composite Deck used on Roof: In addition to the minimum attachment specified above, typical areas of the roof deck shall be welded to resist the net uplift pressures as specified in the General Notes on the drawings
6. Minimum Bearing: Provide a minimum deck bearing of 1 1/2" over all supports with butted end joints.

C. Welding Requirements: Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

D. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking.

E. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work.

F. Hanger Slab or Clips: Provide UL approved punched hanger slots between cells or flutes of lower element where floor deck units are to receive hangers for support of ceiling construction, air ducts, diffusers, or lighting fixtures.

1. Hanger clips designed to clip over male side lap joints of floor deck units may be used instead of hanger slots.
2. Locate slots or clips at not more than 14" o.c. in both directions, not over 9" from walls at ends, and not more than 12" from walls at sides, unless otherwise shown.
3. Provide manufacturer's standard hanger attachment devices.
4. Loads hanging from metal deck slabs shall not exceed 100 pounds unless specifically detailed otherwise on the drawings.

G. Joint Covers and Cell Closures: Weld steel sheet joint covers at abutting ends, except where taped joints are specified. Weld steel sheet column closures, cell closures and Z-closures to deck with 1" long weld at 12" maximum centers to provide tight-fitting closures at open ends of ribs, unless shown otherwise on the drawings.

H. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated. Provide minimum 2" bearing over steel support.

3.2 TOUCH-UP PAINTING

After deck installation, wire brush, clean and paint scarred areas, welds and rust spots on top and bottom surfaces of decking units and supporting steel members.

Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.

Touch-up painted surfaces with same type of shop paint used on adjacent surfaces.

In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.

3.3 INSPECTION

Welded decking in place is subject to inspection and testing by the Design Professional's Testing Laboratory. Expense of removing and replacing portions of decking for testing purposes will be borne by Design Professional if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptable work. Cost of such removal and replacement shall be borne by the Contractor.

END OF SECTION

SECTION 05 4100

COLD-FORMED STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cold-formed steel stud framing assemblies and supplementary items necessary for installation.

1.2 DELEGATED ENGINEERING REQUIREMENTS

A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required and shall not be construed as an engineered design. Furnish and install all Work required for a complete installation.

B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents including, but not limited to, the following:

1. Preparation of structural analysis data including engineering calculations, shop drawings, and other submittals signed and sealed by the qualified professional engineer responsible for their preparation.

C. Coordination of Contract Documents and Work:

1. Product Variations: In the event of minor differences between products and systems of available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, and installation instructions.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Provide dimensioned drawings showing layout, spacings, sizes, thicknesses, and types of cold-formed metal framing. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, and connection details.

C. Welding Certificates: Written certifications for welding procedures and personnel.

D. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.

E. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1. Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Miscellaneous structural clips and accessories.

F. Research/Evaluation Reports: Evidence of cold-formed metal framing's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

G. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control" Article.

H. Qualification Data: For manufacturer, installer, and professional engineer.

1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
2. Architect may waive submittal of qualification data for available manufacturers listed in this Section.
3. Architect may waive submittal of qualification data for available manufacturers listed in this Section.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 10 years, and with sufficient production capability, facilities, and personnel to produce required Work.

B. Installer Qualifications:

1. Experience: Installer with not less than 5 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years, and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project during times specified Work is in progress that is experienced in installing systems similar to type and scope required for Project.

C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated that have resulted in installations of products and systems similar to this Project and has a record of successful in-service performance.

D. Testing Agency Qualifications: An independent testing agency, qualified according to ASTM E 329 to conduct the testing indicated.

E. Welding: Qualify procedures and personnel according to AWS qualification requirements and following:

1. AWS D1.1/D.1.1M, "Structural Welding Code - Steel".
2. AWS D1.4, "Structural Welding Code - Reinforcing Steel".

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

a. Owner.
b. Architect.
c. Contractor, including superintendent.
d. Installer, including project manager and supervisor.
e. Installers of other construction interfaced with Work.
f. Testing agency.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, and installing the Work. Demonstration shall include, but not be limited to, the following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate and other preparatory work performed by other trades.
b. Review Work requirements (Drawings, Specifications, and other Contract Documents).
c. Review required submittals, both completed and yet to be completed.
d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
e. Review required inspection, testing, certifying, and material usage accounting procedures.
f. Review environmental conditions and procedures for coping with unfavorable conditions.
g. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.6 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing protected with a waterproof covering, and ventilate to avoid condensation.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated and without permanent deformation or failure of materials.

1. Determine allowable working stresses of materials according to applicable local building codes, or information indicated, or, if standard not indicated, use latest editions of following:

a. Structural Steel: AISC - "Manual of Steel Construction".
b. Cold-Formed Structural Steel:

1) AISI SG-673, Part 1 - "Specification for the Design of Cold-Formed Steel Structural Members".
2) "AISI Specification Provisions for Screw Connections".

c. Welding of Steel: AWS - "D1.1".
d. Welding of Sheet Steel: AWS - "D1.4".

B. Design Loads: Engineer to withstand design loads including but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by applicable local building codes, and as indicated.

1. Structural Movement: Engineer to withstand movements of structure including, but not limited to, drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads. Contractor shall obtain required design data and identify movements accommodated on submittal drawings.

a. System shall accommodate plus or minus 3/8 in (10 mm) differential vertical deflection of floors.
b. Maintain exterior wall design and incorporate an expansion and contraction joint located above ceiling line to isolate movement between interior and exterior finishes.
c. Stud depth and spacing indicated is critical for performance of other materials and shall not be changed without consideration of other materials.

C. Deflection of Framing Members: Engineer framing systems to withstand design loads without deflections greater than following, without contribution from sheathing materials:

a. Typical Exterior Wall Framing: Horizontal deflection of 1/360 of wall span.
b. Exterior Masonry Wall Framing: Horizontal deflection of 1/720 of wall span.

D. Thermal Movements: Engineer products and systems to accommodate thermal movements of supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses, damaging loads on fasteners, failure of operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.

E. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

F. Fire-Test-Response Characteristics: Where metal framing is part of a fire-resistance-rated assembly, provide framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual," or by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.

2.3 MATERIALS

A. Steel Sheet: ASTM A 1003 / A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade:

a. ST33H (ST230H) for minimum uncoated steel thickness of 0.0428 in (1 mm) and less.
b. ST50H (ST340H) for minimum uncoated steel thickness of 0.0538 in (1.3 mm) and greater.

2. Protective Coating: ASTM A 653 / A 653M, G90 (Z275) hot-dip galvanized coating.

3. Conversion of Gage to Minimum Thickness for Metal Framing: When metal framing is indicated to be of a specific gage thickness, following shall be uncoated base metal thickness according to SSMAs "Product Technical Information", 2000:

   a. 18 Gage: 0.0451 in (1.15 mm) design thickness; 43 mils minimum thickness.
   b. 16 Gage: 0.0566 in (1.44 mm) design thickness; 54 mils minimum thickness.
   c. 14 Gage: 0.0713 in (1.81 mm) design thickness; 68 mils minimum thickness.
   d. 12 Gage: 0.1017 in (2.58 mm) design thickness; 97 mils minimum thickness.

   Minimum thickness represents 95 percent of the design thickness and is minimum acceptable thickness of material for Work.

B. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base Metal Thickness: Not less than 18 gage 0.0451 in (1.15 mm) thick.
2. Flange Width: 1-5/8 in (40 mm) minimum.

C. Steel Track (Runners): Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched (except as noted below), with unstiffened flanges, and as follows:

1. Minimum Base Metal Thickness: As required by delegated engineering, not less than 18 gage 0.0451 in (1.15 mm) thick.
2. Flange Width: Manufacturers standard deep flange, minimum 3 in (75 mm), at head of exterior walls where studs occur between structural floors, standard flange elsewhere.
3. Web: Bottom track punched with 1 in (25 mm) diameter holes at 24 in (600 mm) on center over openings to prevent track from holding water, unpunched elsewhere.

2.4 ACCESSORIES

A. Framing Components: As required by delegated engineering fabricated from ASTM A 1003 / A 1003M, Structural Grade, Type H, metallic coated, steel sheet of same grade and coating weight used for framing members.

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Gusset plates.
5. Deflection tracks and clips.
6. Stud kickers, knee braces, and girts.
7. Reinforcing and backer plates.
8. Hole-reinforcing plates.

B. Metal Deck: 9/16 in (14 mm), corrugated, ASTM A 653 / A 653M, G90 (Z275) hot-dip galvanized coating.

C. Steel Shapes and Clips: ASTM A 36 / A 36M, zinc coated by hot-dip process according to ASTM A 123 / A 123M.

D. Anchor Bolts: ASTM F 1554, grade required by delegated engineering, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153 / A 153M, Class C.

E. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing according to ASTM E 488 conducted by a qualified independent testing agency.

F. Powder-Actuated Anchors: Suitable for application indicated, ANSI A10.3; low velocity, powder-actuated fasteners; drive pins and clip angles fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, an ultimate load capacity not less than 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.

1. Manufacturers:

   a. Hilti Corp.
   b. ITW Ramset/Red Head.
   c. Powers Fasteners.
   d. Simpson Strong Tie Anchor Systems.

G. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws; low-profile head beneath sheathing, manufacturer's standard elsewhere.

H. Welding Electrodes: Comply with AWS standards.

I. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing minimum of 94 percent zinc dust by weight.

J. Non-Metallic, Non-Shrink Grout: ASTM C 1107, premixed, non-metallic, non-corrosive, non-staining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents with fluid consistency and 30 minute working time.

K. Shims: Load bearing, high-density, non-leaching multimonomer plastic.

L. Thermal Insulation: For boxed-in sections, ASTM C 665, Type I, unfaced mineral-fiber blankets produced by combining glass or slag fibers with thermosetting resins.

2.5 FABRICATION

A. Fabrication Provisions: Fabricate cold-formed steel stud framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Shop welding of 0.0747 in (1.90 mm) or thicker components is acceptable. Wire tying of framing members is not permitted.

   a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding Work.
   b. Screw fasteners penetrating joined members by not less than 3 exposed screw threads.

4. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

B. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 in per 10 ft (3 mm per 3 m) (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 in (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 in (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. AISI's "Standard for Cold-Formed Steel Framing - General Provisions".
2. Respective manufacturer's written installation instructions.
3. Accepted submittals.
4. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before Application: Attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
2. After Application: Remove only as needed to complete installation of cold-formed steel stud framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.4 INSTALLATION

A. Installation Options: Cold-formed steel stud framing may be shop or field fabricated for installation, or it may be field assembled.

B. Bearing Preparation: If required, grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

C. General Installation Provisions: Install cold-formed steel stud framing and securely anchor to supporting structure as required by delegated engineering.

1. Install framing and accessories plumb, square, and true to line, and with connections securely fastened.

    a. Cut framing members by sawing or shearing; do not torch cut.
    b. Fasten by welding, screw fastening, clinch fastening, or riveting according to delegated engineering. Wire tying of framing members is not permitted.

2. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
3. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
4. Do not bridge building expansion and deflection joints with framing. Independently frame both sides of joints.
5. Install insulation in built-up exterior framing members such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing Work.
6. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

D. Steel Tracks: Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure at spacings not greater than 24 in (600 mm) on center using any of following:

1. Anchor bolts.
2. Expansion anchors.
3. Powder-actuated anchors.

E. Steel Studs: Fasten both flanges of studs to top and bottom track, unless otherwise indicated.

1. 16 in (400 mm) maximum stud spacing, unless otherwise indicated.
2. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
3. Install supplementary framing, blocking, and bracing where required to support additional loads.

F. Isolation from Structure: Isolate framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install deflection tracks and anchor to building structure.
2. Connect deflection clips to bypassing studs and anchor to building structure.

G. Headers: Install headers over wall openings wider than stud spacing. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame.
2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Horizontal Bridging: Install horizontal bridging in stud system, spaced in rows not more than 54 in (1350 mm) apart. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle.
2. Deflection Track: Install row of bridging within 18 in (450 mm) of deflection track.

I. Miscellaneous Framing and Connections: Install stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide complete and stable framing.

J. Erection Tolerances: Install cold-formed metal framing plumb, level, accurately aligned, and located in reference to column lines and floor levels. Adjust Work to conform to tolerances indicated below. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

1. Maximum allowable tolerance variation of 1/8 in per 10 ft (3 mm per 3 m) (1:960).
2. Space individual framing members no more than plus or minus 1/8 in (3 mm) from plan location.

3.5 FIELD QUALITY CONTROL

A. Testing Agency Field Service: Design Professional will employ a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

B. Field and shop welds will be subject to inspection and testing.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

3.6 ADJUSTMENTS

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel stud framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION

SECTION 05 4300

SLOTTED CHANNEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Slotted channel framing and supplementary items necessary for installation.

1.2 SYSTEM DESCRIPTION

A. Equipment Support System: Framing system consisting of necessary slotted channel framing members such as beams, columns, braces, fittings, spanning members, longitudinal rails, track supports, and components such as channel connectors, nuts, bolts, washers, shim plates, and general hardware, for a complete and properly functioning support structure for equipment.

1.3 PERFORMANCE REQUIREMENTS

A. Performance Responsibility: Contractor shall comply with performance requirements indicated and specified to provide support structure for scheduled equipment provided under separate specification.

B. Contract Document Limitations: Drawings and Specifications are an outline of criteria and performance requirements, do not necessarily indicate or specify total work required and may not cover some minor related conditions which may be required, and shall not be construed as an engineered design. Requirements indicated by details or specified are intended to establish basic aspects of system, conditions, dimensions, sight lines and profiles.

C. Design Responsibility:

1. Engineering Design: Provide design and engineering for each member and component of slotted channel framing system to support scheduled equipment, including attachment to building structure, by employing a design engineer to prepare engineering calculations, shop drawings and other submittals, and other structural data; and to inspect completed installation as indicated under "Field Quality Control" Article below.
2. Design Engineer Scope of Service: Affix seal to shop drawings, engineering calculations, and other submittals according to respective jurisdictional licensing regulations.

D. Deviations: Minor dimension and profile adjustments may be made in proposed design in interest of fabrication or erection methods or techniques, or ability to satisfy design and performance requirements, provided intent of Contract Documents is maintained as determined by Architect.

E. Structural Requirements:

1. Scope: Design, engineer, fabricate, and install slotted channel framing system to support loads within limits and under conditions indicated, without material failure or permanent deformation of structural members and components. Include design and engineering to withstand effects of earthquake motions.
2. Design Loads: As required by scheduled equipment.

3. Deflection: L/720 of span in either plane (vertical or horizontal) when maximum loading conditions is applied on either rail, due to equipment operation, including positioning of equipment at extremities of its travel.
4. Design Criteria:

    a. Equipment Information: Coordinate design and engineering with information provided by manufacturer of equipment being supported.
    b. Minimum Factor of Safety: 2 based on ultimate strength under static loading conditions.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical literature of framing system components and related accessories.

B. Shop Drawings: Submit dimensioned plans, elevations, and details indicating slotted channel framing channels, components, and hardware; include the following:

1. Strapping, bracing, bridging, splices, and connection details.
2. Spacings, materials, sizes, and thicknesses.
3. Specifics for equipment being supported by system.
4. Adjacent building structure, mechanical and electrical elements.
5. Details for anchoring and attachment to building structure.

C. Calculations: For information only, submit engineering calculations sealed by design engineer; include, but not limit to, following:

1. Indicate design loads for scheduled equipment to be supported.
2. Analysis of loads on framing members.
3. Analysis of loads on anchors.
4. Section property computations for framing members

D. Engineer's Certification: For information only, submit statement certified by design engineer that design of framing system, including connections to building structure, is in compliance with provisions of Contract Documents and local building code, and is in keeping with generally accepted engineering practice.

1.5 QUALITY ASSURANCE

A. Pre-Installation Conference: Before commencement of framing work, conduct conference at Project site to comply with requirements of Division 01 Sections.

B. Design Engineer Qualification: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated that have resulted in installation of slotted channel framing system similar to this Project in material, design, and extent.

C. Design Standards: In designing and engineering slotted channel framing system, determine allowable design working stresses of materials based on local building code, or, if code does not specify a requirement, use latest editions of MFMA-4 and MFMA-103.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Provide one of manufacturers and product series listed.

1. Cooper B-Line, Inc.
2. Hilti.
3. Unistrut Corp.

B. Product Standards (Basis of Design): Contract Documents are based on following products manufactured by Unistrut Corp. to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and do not change intended aesthetic, functional and performance requirements as judged by Architect.

1. Horizontal Spanning Members – Upper, Lower and Main Subrails: "P5501" channels.
2. Vertical Columns: "P9200" tubes.
3. Diagonal and Horizontal Bracing: "P1000" channels.
4. Inside Vertical Columns: "P1000 H3" channels.

2.2 MATERIALS AND COMPONENTS

A. Slotted Channels:

1. Product Quality Standard: MFMA-4.
2. Description: C-shape channels fabricated from ASTM A 1011 Grade 33 cold-rolled steel sheet or ASTM A 1008 Grade 33 for hot-rolled steel sheet, structural classification; with continuous open slot formed by inturned serrated or unserrated lips, and intermediate slots in back of channel; riveted back-to-back type for primary horizontal framing members; wall thickness as required by engineering design.
3. Profile Size: 1-5/8 inches wide by depth required by engineering design.
4. Painted Factory Finish: Chemically cleaned, phosphated, electro deposited acrylic or electrostatically-applied polyester finished, then baked; resisting minimum 300 hours of salt spray exposure according to ASTM B 117.

B. Channel Connectors: Standard 2 part connectors of type, size and material required by engineered design; fabricated from carbon steel with nuts and threaded bolts; with or without springs; electro-galvanized finish; from same manufacturer as slotted channels.

C. General Hardware: Standard fittings, bases, brackets, and clamps of three-dimensional shape suitable for condition and type, size and material required by engineered design; fabricated from carbon steel; same finish as slotted channels; from same manufacturer as slotted channels.

D. Fasteners to Building Structure: Welding rods and expansion anchors as specified in Division 05 Section "Metal Fabrications".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Conditions: Examine substrate surfaces to which slotted channel framing will be placed for compliance with requirements, installation tolerances and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:

1. MFMA-103.
2. Respective manufacturer's written installation instructions.
3. Approved submittals.
4. Contract Documents.

B. Erection:

1. Install slotted channel framing members and components square, true to line, level and plumb; and securely in place to properly support schedule equipment.
2. Cut slotted channels with powered cutting saws; flame-cutting is not permitted.
3. Tighten all connections to torque required by engineering design.

C. Tolerances:

1. Horizontal Mounting Surfaces: Align within 1/32 inch in 24 inches and within 1/16 inch in 18 feet.
2. Elevation Between Rails: Difference between 2 rails within 1/16 inch in 24 inches.

3.3 FIELD QUALITY CONTROL

A. Design Engineer Inspection: Design engineer shall inspect completed installation for compliance with engineered design, and direct Installer to correct portions not in compliance. Upon resolution of deficiencies, design engineer shall certify that installation is in compliance with engineered design.

END OF SECTION

SECTION 05 5000

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes metal fabrications and supplementary items necessary to complete their installation.

B. Structural Steel Framing is specified in Division 05 Section "Structural Steel".

C. Metal Stairs are specified in Division 05 Section "Metal Stairs".

D. Steel Pipe Handrails and Railings are specified in Division 05 Section "Pipe and Tube Railings".

E. Concrete inserts set in formwork are specified in Division 03 Section "Concrete Accessories". Steel plates, shapes and bars are included in this section.

1.2 SUBMITTALS

A. Product Data: For each product specified including paints and grout.

B. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.

1. For installed products indicated to comply with design loads, include shop drawings and structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.

1.3 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal fabrications that are similar to those indicated for this Project in material, design, and extent.

B. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

3. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.4 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements.
2. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.5 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.

D. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

E. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.2 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2.3 FASTENERS

A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A with hex nuts, ASTM A 563 and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36.

D. Machine Screws: ASME B18.6.3.

E. Lag Bolts: ASME B18.2.1.

F. Wood Screws: Flat head, carbon steel, ASME B18.6.1.

G. Plain Washers: Round, carbon steel, ASME B18.22.1.

H. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.

I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Interior Anchors: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Exterior Anchors: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.4 GROUT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Shear and punch metals cleanly and accurately. Remove burrs.

C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

J. Remove sharp or rough areas on exposed traffic surfaces.

K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.6 STEEL LADDERS

A. General: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.

1. Comply with ANSI A14.3, unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.

B. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges, spaced 16 inches (406 mm) apart.

C. Bar Rungs: 3/4-inch-diameter steel bars, spaced 12 inches o.c.

D. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.

E. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3.

F. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

G. Galvanize ladders, including brackets and fasteners, at exterior locations.

2.7 LOOSE STEEL LINTELS

A. Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches, unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.

B. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches wide by 1/4 inch thick by 8 inches long at 24 inches o.c., unless otherwise indicated.

C. Fabricate supports for operable partitions as follows:

1. Beams: Continuous steel shapes of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Fabricate support for suspended toilet compartments as follows:

1. Beams: Continuous steel shapes of size required to limit deflection to L/360 between hangers, but use not less than size indicated on drawings.
2. Hangers: Steel rods, 1/2-inch-diameter, spaced not more than 36 inches o.c. Thread rods to receive anchor and stop nuts. Fit hangers with wedge shape washers for full bearing on sloping flanges of support beam.
3. Braces and Angles: Steel angles of size required for rigid support of beam and for secure anchorage.

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches from each end, 6 inches from corners, and 24 inches o.c., unless otherwise indicated.

C. Galvanize miscellaneous steel trim at exterior locations.

2.10 PIPE BOLLARDS

A. Fabricate pipe bollards from Schedule 40 galvanized steel pipe, size as indicated but not less than 6 inches.

1. Fill inside of pipe solid with minimum 3,000 psi concrete.
2. Cap bollards with PVC cap set with epoxy adhesive.

2.11 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish metal fabrications after assembly.

B. Galvanizing: Hot-dip galvanize items indicated to be galvanized and comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

D. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive metal fabrications and associated work and conditions under which work will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to Installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

3.3 INSTALLING MISCELLANEOUS ITEMS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

B. Operable Partition Supports: Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Toilet Partition Supports: Anchor supports for toilet partitions securely to and rigidly brace from building structure.

D. Pipe Bollards in Footing: Anchor bollards in place with 18 inch diameter concrete footings 36 inches deep. Support and brace bollards in position in footing excavations until concrete has been placed and cured. Fill solidly with concrete.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

GEORGIA STATE INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 05 5100

METAL STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this Section includes metal stairs and supplementary items necessary to complete their installation.

B. Handrails and railings attached to metal stairs are specified in Division 05 Section "Pipe and Tube Railings".

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal stairs capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component of metal stairs.

1. Treads and Platforms: Capable of withstanding a uniform load of 100 lbf/sq. ft. or a concentrated load of 300 lbf on an area of 4 sq. in., whichever produces the greater stress.
2. Stair Framing: Capable of withstanding stresses resulting from loads specified above in addition to stresses resulting from railing system loads.
3. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.
4. Handrails and Railings: Refer to Division 05 Section "Pipe and Tube Railings".

1.3 SUBMITTALS

A. Product Data: Manufactured products used in fabricating metal stairs including extruded nosings and paint products.

B. Shop Drawings: Show fabrication and installation details for metal stairs. Include plans, elevations, sections, and details of metal stairs and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.

1. For installed products indicated to comply with design loads, include shop drawings and structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Arrange for metal stairs specified in this Section to be fabricated and installed by the same firm.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal stairs (including handrails and railing systems) that are similar to those indicated for this Project in material, design, and extent.

C. Fabricator Qualifications: A firm experienced in producing metal stairs similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

1.5 COORDINATION

A. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. At Contractor's option provide metal stairs fabricated by local metal stair fabricators meeting qualification requirements or purchased from acceptable manufacturers listed.

B. Provide product by one of the following manufacturers:

1. Alfab, Inc., Stairco; Stairco Drop-in.
2. American Stair Corporation; Speed Stair.
3. Sharon Ornamental Iron, Inc.; Drop-in Stairs.

2.2 FERROUS METALS

A. Metal Surfaces, General: Provide metal free from pitting, seam marks, roller marks, and other imperfections where exposed to view on finished units. Do not use steel sheet with variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.

B. Steel Plates, Shapes, and Bars: ASTM A 36.

C. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.

D. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

E. Uncoated, Hot-Rolled Steel Sheet: Commercial quality, complying with ASTM A 569 or structural quality, complying with ASTM A 570, Grade 30, unless another grade is required by design loads.

F. Galvanized Steel Sheet: ASTM A 653, G90 coating, either commercial quality or structural quality, Grade 33, unless another grade is required for design loads.

G. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Machine Screws: ASME B18.6.3.

D. Lag Bolts: ASME B18.2.1.

E. Plain Washers: Round, carbon steel, ASME B18.22.1.

F. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Interior Environments: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

2.4 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

2.5 CONCRETE FILL AND REINFORCING MATERIALS

A. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 3000 psi, unless higher strengths are indicated.

B. Welded Wire Fabric: ASTM A 185, 6 by 6 inches --W1.4 by W1.4, unless otherwise indicated.

2.6 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, handrails, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding, unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for Commercial class, unless more stringent requirements are indicated.

C. Shop Assembly: Preassemble stairs in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

D. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Shear and punch metals cleanly and accurately. Remove sharp or rough areas on exposed surfaces.

E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.7 STEEL-FRAMED STAIRS

A. Stair Framing: Fabricate stringers of structural-steel channels, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural-steel channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers; bolt or weld framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.

1. Where stairs are enclosed by gypsum board wall assemblies, provide hanger rods to support landings from floor construction above. Locate hanger rods within stud space of wall construction.
2. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

B. Metal Risers, Subtread Pans, and Subplatforms: Form to configurations shown from steel sheet of thickness necessary to support indicated loads, but not less than 0.0677 inch.

1. Steel Sheet: Uncoated hot-rolled steel sheet, unless otherwise indicated.
2. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding.
3. Shape metal pans to include nosing integral with riser.
4. Provide subplatforms of configuration the same as subtreads. Weld subplatforms to platform framing.

C. Handrails and Railings: Fabricate handrails and railings to comply with requirements indicated in Division 05 Section "Pipe and Tube Railings".

1. Guardrail Configuration: 1-1/4-inch-diameter top and bottom rails, 1-1/4-inch-diameter posts, and 1/2-inch-diameter balusters spaced not more than 4 inches o.c.

2. Handrail Configuration: 1-1/2 inch O.D. round rail.

D. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting railings and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

1. Connect railing posts to stair framing by direct welding, unless otherwise indicated.

2.8 FINISHES

A. Comply with NAAMM'S "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish metal stairs after assembly.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed products:

1. Exteriors (SSPC Zone 1B): SSPC SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC SP 3, "Power Tool Cleaning."

C. Apply shop primer to prepared surfaces of metal stair components, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive metal stairs and associated work and conditions under which work will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

G. Concrete Treads: Fill tread and landing metal pans with concrete, smooth and level with float finish.

H. Cast extruded abrasive nosings into concrete treads as concrete is poured. Make nosings full width of tread, with noses flush with riser faces and level with tread surfaces.

I. Weld handrails and railing systems to stair members as indicated in Division 05 Section "Pipe and Tube Railings".

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION

GEORGIA STATE INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 05 5213

PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this Section includes pipe and tube handrails, railings and supplementary items necessary to complete their installation.

B. Ornamental railings are specified in Division 05 Section "Ornamental Handrails and Railings".

1.2 PERFORMANCE REQUIREMENTS

A. General: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of handrail and railing materials based on the following:

1. Structural Steel: AISC S335, "Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary."
2. Cold-Formed Structural Steel: AISI SG-673, Part I, "Specification for the Design of Cold-Formed Steel Structural Members."

B. Structural Performance: Provide handrails and railings capable of withstanding structural loads required by ASCE 7 without exceeding allowable design working stresses of materials for handrails, railings, anchors, and connections.

C. Thermal Movements: Provide handrails and railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.3 SUBMITTALS

A. Product Data: For brackets, grout and paint products:

B. Shop Drawings: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, component details, and attachments to other Work.

1. For installed handrails and railings indicated to comply with design loads, include shop drawings and structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of handrails and railings that are similar to those indicated for this Project in material, design, and extent.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating handrails and railings without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.6 COORDINATION

A. Coordinate installation of anchorages for handrails and railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide specific product, material or manufacturer listed under each item below.

2.2 METALS

A. General: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.

B. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:

1. Black finish, unless otherwise indicated.
2. Galvanized finish for exterior installations and where indicated.
3. Type S, Grade A, standard weight (schedule 40), unless otherwise indicated, or another weight required by structural loads.
4. 1-1/4 inch I.D. (1.66 inch O.D.) for guardrail verticals and horizontals.

C. Steel Tubing for Handrails: ASTM A 500, Grade A unless other grade required by structural design, 1-1/2 inch outside diameter, not less than 13 gage.

D. Steel Plates, Shapes, and Bars: ASTM A 36.

1. 1/2-inch-diameter bars for balusters.

E. Brackets:

1. Malleable iron with concealed steel hanger bolt and with leads shields for concrete and CMU walls. Curved top for rail. 1-1/2-inch-dimension, inside face of rail to finished wall surface.
2. Acceptable Manufacturers:

a. Julius Blum & Co., Inc.
b. J. G. Braun Company.
c. The Lifeguard Corporation.
d. A. R. Nelson Co., Inc., ARNCO.

F. Flanges, and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

2.3 WELDING MATERIALS, FASTENERS, AND ANCHORS

A. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Fasteners for Anchoring Handrails and Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.

1. Use plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

C. Cast-in-Place and Postinstalled Anchors: Fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.4 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

2.5 GROUT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION

A. General: Fabricate handrails and railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble handrails and railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Form changes in direction of railing members as follows:

1. By flush radius bends.
2. By mitering at elbow bends.
3. By inserting prefabricated flush-elbow fittings.
4. By any method indicated above, applicable to change in direction involved.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

E. Welded Connections: Fabricate handrails and railings for connecting members by welding. Cope components at perpendicular and skew connections to provide close fit, or use fittings designed for this purpose. Weld connections continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

F. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing members to other work, unless otherwise indicated.

G. Provide inserts and other anchorage devices for connecting handrails and railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.

H. For railing posts set in concrete, provide preset sleeves of steel not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, and steel plate forming bottom closure.

I. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

J. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

K. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.

L. Close exposed ends of handrail and railing members with prefabricated end fittings.

M. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of railing and wall is 1/4 inch or less.

N. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

O. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.7 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed handrails and railings:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush-off Blast Cleaning."

C. Application of Shop Primer: Apply shop primer to prepared surfaces of handrail and railing components, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Stripe paint edges, corners, crevices, bolts, and welds.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive railing system and associated work and conditions under which pipe and tube railings will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required to install handrails and railings. Set handrails and railings accurately in location, alignment, and elevation; measured from established lines and levels and free from rack.

1. Do not weld, cut, or abrade surfaces of handrail and railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Adjust handrails and railings before anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints where joints occur in substrates and no farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS AND RAILING

A. Posts: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with grout anchoring material, mixed and placed to comply with anchoring material manufacturer's written instructions:

1. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch build-up, sloped away from post.
2. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, weld flanges to posts and bolt to metal supporting members.
3. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

B. Railing Ends: Anchor railing ends to wall construction with round flanges connected to railing ends and anchored into wall construction with postinstalled anchors and bolts.

C. Handrails: Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets at spacing required to support structural loads, but not less than 5 feet on center. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.

3.5 CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.

END OF SECTION

SECTION 05 7300

ORNAMENTAL HANDRAILS AND RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes ornamental handrails, railings and supplementary items necessary to complete their installation.

B. Handrails and railings fabricated from steel pipe and tube components are specified in Division 05 Section "Pipe and Tube Railings".

1.2 PERFORMANCE REQUIREMENTS

A. General: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of materials based on the following:

1. Aluminum: AA 30, "Specifications for Aluminum Structures."
2. Stainless Steel: ASCE 8, "Specification for the Design of Cold-Formed Stainless Steel Structural Members."
3. Cold-Formed Structural Steel: AISI SG-673, Part I, "Specification for the Design of Cold-Formed Steel Structural Members."
4. Glass: For fully tempered glass in glass-supported handrails and railings, use a safety factor of 4 applied to the applicable modulus of rupture listed in "Mechanical Properties" in AAMA Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."

B. Structural Performance: Provide handrails and railings capable of withstanding structural loads required by ASCE 7 without exceeding allowable design working stress of materials for handrails, railings, anchors, and connections.

C. Glass-Supported Handrails and Railings: Provide glass-supported handrails and railings capable of withstanding loads indicated. Support each section of top rail by a minimum of three glass panels or by other means so top rail will remain in place if any one panel fails.

D. Thermal Movements: Provide handrails and railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.3 SUBMITTALS

A. Product Data: For manufacturer's product lines of handrails and railings assembled from standard components.

1. Include Product Data for grout, anchoring cement, and paint products.

B. Shop Drawings: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, details, and attachments to other Work.

1. For installed handrails and railings indicated to comply with design loads, include shop drawings signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Verification: For each type of exposed finish required, prepared on components indicated below and of same thickness and metal indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. 6-inch-long sections of each different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.
3. Assembled Samples of railings, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

D. Product Test Reports: Indicating products comply with requirements, based on comprehensive testing of current products.

1.4 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of handrails and railings that are similar to those indicated for this Project in material, design, and extent.

B. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

D. Preconstruction Testing Service: Engage a qualified independent testing agency to test handrails and railings for compliance with specified requirements for performance and test methods. Conduct tests using specimens and assemblies representative of proposed materials and construction.

E. Mock-up: Before installing handrails and railings, build mock-up to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-ups to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-ups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches in length unless otherwise indicated.
2. Notify Architect seven days in advance of dates and times when mock-ups will be constructed.
3. Obtain Architect's approval of mock-ups before fabricating ornamental handrails and railings.

4. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.
5. Demolish and remove mock-ups when directed unless approved by Architect to become part of the completed Work if undisturbed at time of Material Completion.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating handrails and railings without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.6 COORDINATION

A. Coordinate installation of anchorages for handrails and railings. Furnish Setting Drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.7 SCHEDULING

A. Schedule installation so handrails and railings are mounted only on completed walls. Do not support temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Blum: Julius Blum & Co., Inc.
2. Blumcraft of Pittsburgh.
3. Construction Services, Inc.
4. CraneVeyor Corp.
5. C.R. Laurence Co., Inc.
6. Livers Bronze Co., Inc.
7. Newman Brothers, Inc.
8. Royal Architectural Systems.
9. Sterling Dula Architectural Products.
10. The Wagner Companies.
11. U.R. Railings / Custom Components.

2.2 METALS

A. General: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.

B. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties of alloy and temper required for structural performance requirements of railing designs indicated.

1. Extruded Bar and Tube: ASTM B 221.
2. Plate and Sheet: ASTM B 209.

C. Stainless Steel: Grade or type designated below for each form required.

1. Tubing: ASTM A 554, Grade MT 304.
2. Pipe: ASTM A 312/A 312M, Grade TP 304.
3. Plate: ASTM A 666, Type 304.

D. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

1. Provide formed or cast brackets with predrilled hole for exposed anchorage.

2.3 GLASS RAILING MATERIALS

A. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated), Type 1 (transparent glass, flat), Quality q3 (glazing select). Provide products complying with requirements indicated below for class, thickness, and manufacturing process that have been tested for surface and edge compression according to ASTM C 1048 and for impact strength according to 16 CFR, Part 1201 for Category II materials.

1. Clear Glass: Class 1 (clear).
2. Thickness: 12.0 mm. (1/2 inch) unless otherwise required to meet design load.
3. Manufacturing Process: Manufacture fully tempered glass by horizontal (roller-hearth) process with roll-wave distortion parallel with bottom edge of glass as installed.
4. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

B. Base Mounting Bracket: Manufacturer's standard extruded aluminum shoe moulding, designed to meet structural performance specified, size to fit glass thickness and type required for mounting condition indicated.

C. Glazing Cement and Accessories: Provide glazing cement and related accessories recommended or supplied by railing manufacturer for bonding glass to metal subrails.

2.4 FASTENERS

A. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.

B. Fasteners for Interconnecting Components: Use fasteners fabricated from same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other Work, unless exposed fasteners are unavoidable.
2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated and locate in inconspicuous locations.

C. Postinstalled Anchors: Fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.5 PAINT

A. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.6 GROUT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.7 FABRICATION

A. Assemble handrails and railings in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

B. Form changes in direction of railing members by flush radius bends or flush elbow fittings.

C. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

D. Mechanical Connections: Fabricate handrails and railings by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using epoxy structural adhesive where this is manufacturer's standard splicing method.

E. Brackets, Flanges, Fittings, and Anchors: Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to connect handrail and railing members to other construction.

F. Provide inserts and other anchorage devices to connect handrails and railings to concrete or masonry. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.

G. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

H. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

I. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.

J. Close exposed ends of railing members with prefabricated end fittings.

2.8 GLAZING PANEL FABRICATION

A. Glass Panels: Cut tempered glass to final size and shape before heat treatment; provide for proper edge clearance and bite on glass. Provide thickness indicated, but not less than that required to support structural loads.

B. Straight Panels: Provide tempered glass panels for straight sections.

2.9 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 STAINLESS-STEEL FINISHES

A. Remove or blend tool and die marks and stretch lines into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Polish: No. 4 finish.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive ornamental handrail and railing system and conditions under which work will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing handrails and railings. Set handrails and railings accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

2. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Corrosion Protection: Coat concealed surfaces of aluminum and copper alloys that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust handrails and railings before anchoring to ensure alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Expansion Joints: Install expansion joints where joints occur in substrate and no further apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6 inches of post.

3.4 INSTALLING GLASS PANELS

A. Glass-Supported Handrails and Railings: Install assembly to comply with railing manufacturer's written instructions. Attach base channel to building structure, then insert glass into base channel and bond with glazing cement.

1. Support glass panels in base channel at quarter points with channel-shaped setting blocks that also act as shims to maintain uniform space for glazing cement. Fill remaining space in base channel with glazing cement for uniform support of glass.
2. Adjust spacing of glass panels so gaps between panels are equal before placing glazing cement.

3.5 CLEANING AND PROTECTION

A. Clean surfaces according to written recommendations of metal finisher and manufacturer in a manner that leaves an undamaged and uniform finish matching approved Sample.

B. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Material Completion.

C. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 06 1000

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes rough carpentry work not specified elsewhere and generally intended for support of other work including furring, curbs, cants, miscellaneous blocking, grounds, nailers, and panels.

1.2 PERFORMANCE REQUIREMENTS

1. Fabricate and install rough carpentry associated with flashings and roof coverings to withstand wind loads, structural movement, and thermally induced movement without contributing to failure of flashing or roof coverings.
2. Comply with ANSI/SPRI ES-1 for testing, fabrication and installation of flashings at roof edges.
3. Comply with recommendations of Factory Mutual (FM) Loss Prevention Data Sheet 1-49 for wind zone classification applicable to project conditions.

1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 QUALITY ASSURANCE

A. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.
2. NLGA - National Lumber Grades Authority.
3. SPIB - Southern Pine Inspection Bureau.
4. WCLIB - West Coast Lumber Inspection Bureau.
5. WWPA - Western Wood Products Association.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency if acceptable to authorities having jurisdiction.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.
5. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, for concealed conditions.
6. Provide dry lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, for exposed conditions.

B. Wood Structural Panels:

1. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.
2. Oriented Strand Board: DOC PS 2.
3. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
4. Comply with "Code Plus" provisions in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial."
5. Factory mark panels according to indicated standard.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment: Pressure process complying with AWPA C2 (lumber) and AWPA C9 (plywood) except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. For exposed items indicated to receive painted, stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece, or omit marking and provide certificates of treatment compliance issued by inspection agency if acceptable to authorities having jurisdiction.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members less than 18 inches above grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Provide materials that comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber and ASTM D 5516, for plywood.
2. Use treatment that does not promote corrosion of metal fasteners.
3. Use Exterior type where indicated or required.
4. Use Interior Type A High Temperature (HT), unless otherwise indicated.

B. For exposed items indicated to receive painted, stained, or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

2.4 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction including rooftop equipment bases and support curbs, blocking, cants, nailers, furring.and grounds.

B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 19 percent maximum moisture content and any of the following species:

1. Mixed southern pine; SPIB.
2. Eastern softwoods; NELMA.
3. Northern species; NLGA.
4. Western woods; WCLIB or WWPA.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine, No. 2 grade; SPIB.
2. Eastern softwoods, No. 3 Common grade; NELMA.
3. Northern species, No. 3 Common grade; NLGA.
4. Western woods, Standard or No. 3 Common grade; WCLIB or WWPA.

2.5 PANEL PRODUCTS

A. Miscellaneous Concealed Plywood: Exterior sheathing, span rating to suit framing in each location, and thickness as indicated but not less than 1/2 inch.

B. Miscellaneous Concealed Oriented Strand Board: Exposure 1 sheathing, span rating to suit framing in each location, and thickness as indicated but not less than.

C. Miscellaneous Exposed Plywood: DOC PS 1, A-D Interior, thickness as indicated but not less than 1/2 inch.

D. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch-thick.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, contained within roofing assemblies, in contact with preservative-treated materials or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A with ASTM A 563 hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Interior Anchors: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Exterior Anchors: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive rough carpentry and associated work and conditions under which work will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

D. Securely attach carpentry work according to applicable codes and recognized standards.

E. Use preservative treated wood for roofing and exterior conditions, and use fire-retardant treated wood for building interior conditions.

F. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

3.3 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.4 PANEL PRODUCT INSTALLATION

A. Wood Structural Panels: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 06 1643

EXTERIOR GYPSUM SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Exterior gypsum sheathing products and supplementary items necessary for installation.

1.2 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 for definitions of terms not defined in this Section or in other referenced quality standards.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

D. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

E. Qualification Data: For manufacturer and installer.

1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
2. Architect may waive submittal of qualification data for available manufacturers listed in this Section.

F. Warranty: Sample of warranty.

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years, and with sufficient production capability, facilities, and personnel to produce required Work.

B. Installer Qualifications:

1. Experience: Installer with not less than 5 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years, and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project during times specified Work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.

C. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with minimum of 5 years experience in providing recommendations, observations, evaluations, and problem diagnostics. Sales representatives are not acceptable.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

a. Owner.
b. Architect.
c. Contractor, including superintendent.
d. Installer, including project manager and supervisor.
e. Manufacturer's qualified technical representative.
f. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Work requirements (Drawings, Specifications, and other Contract Documents).
c. Review required submittals, both completed and yet to be completed.
d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
e. Review required inspection, testing, certifying, and material usage accounting procedures.
f. Review environmental conditions and procedures for coping with unfavorable conditions.
g. Resolve deviations or differences between Contract Documents and the manufacturer/fabricator's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.7 PROJECT CONDITIONS

A. Exposure Limitation: Exterior gypsum sheathing shall not be exposed to weather for more than 180 days.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor defects for a period of 5 years from date of Material Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Available Manufacturers and Products: Manufacturers offering products that may be incorporated into the Work include those listed.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality.

2.2 MATERIALS

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Exterior Gypsum Sheathing Boards:

1. Generic Type: Glass-mat faced exterior gypsum sheathing board.
2. Material Quality Standard: ASTM C 1177 / C 1177M, Type X.
3. Description: Paperless, treated, water resistant, noncombustible, gypsum core with inorganic glass mat partially or completely embedded on both faces; acrylic coated on one face; 5/8 in (15 mm) thick. Provide in maximum lengths and widths available that will

minimize short-edge-to-short-edge butt joints and to correspond to support system indicated.

4. Manufacturers and Products:

    a. CertainTeed Corporation; GlasRoc Sheathing, Type X.
    b. Georgia-Pacific Gypsum LLC; DensGlass Gold Fireguard Type X Sheathing.
    c. National Gypsum Properties, LLC; Gold Bond Brand e²XP Fire-Shield Extended Exposure Sheathing.
    d. Temple-Inland, Inc.; GreenGlass Fiberglass-Faced Gypsum Sheathing, Type X.
    e. United States Gypsum Company (USG); Securock Firecode Type X Glass-Mat Sheathing.

C. Horizontal Roof Cover Boards: As specified in Division 07 Section for roofing membrane.

D. Screw Fasteners:

1. Material Quality Standards:

    a. Metal Framing Members less than 0.030 in (0.75 mm) Thick: ASTM C 1002, Type S.
    b. Metal Framing Members from 0.033 in to 0.112 in (0.79 mm to 2.9 mm) Thick: ASTM C 954, Type S-12.

2. Product Description - Standard Applications: Bugle head, self-drilling, self-tapping, steel screws with Phillips-head recess of size, holding power, and other properties recommended by manufacturer; minimum 1 in (25 mm) long; with corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
3. Limitation: Nails and staples are not permitted.

E. Joint Treatment Materials:

1. General: Joint treatment materials shall be acceptable to board manufacturer for use in sealing joints, and with a history of successful in-service use.
2. Glass-Fiber Mesh Tape: Self-adhering glass-fiber mesh tape, 10 by 10 or 10 by 20 threads per 1 in (25 mm); minimum 2 in (50 mm) wide.

    a. Manufacturers and Products:

        1) Certainteed; BPB Marco; Fiberglass Drywall Mesh Tape.
        2) National Gypsum; ProForm Fiberglass Mesh Tape.
        3) Quik Tape; Quik Tape.
        4) USG; SheetRock Fiberglass Drywall Tape.

3. Air Barrier Membrane Mastic:

    a. Description: Single component, liquid-applied, non-asphaltic, vapor permeable rubberized (elastomeric) membrane which cures to a seamless monolithic rubber-like membrane to resist air leakage.
    b. Water Vapor Permeance: 21 perms per ASTM E 96, Procedure B.
    c. Basis of Design: Henry Company; Air-Bloc 31 Liquid Emulsion Vapor Permeable Air Barrier Membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standard: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. GA-253.
2. ASTM C 1280.
3. Respective manufacturer's written installation instructions.
4. Accepted submittals.
5. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. Installation of Exterior Gypsum Sheathing Boards:

1. Install boards with coated face out, with panel lengths oriented vertically or horizontally as recommended by manufacturer, with vertical edges centered over flanges of studs, with edges and ends fitted tightly together.
2. Do not install imperfect, damaged, wet, or damp boards.
3. Cut boards at penetrations, edges, and other obstructions of the Work; fit tightly against abutting construction, except provide maximum 3/8 in (10 mm) setback where boards abuts structural elements or materials that may retain moisture.
4. Coordinate installation of boards with flashing and joint treatment so materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.
5. Install screws at perimeter and within field to each stud approximately 8 in (200 mm) on centers; set back minimum 3/8 in (10 mm) from edges and ends; apply so screw heads bear tightly against board face but do not cut into facing.
6. Do not bridge building expansion joints with boards; cut and space edges to match spacing of structural support elements.

B. Joint Treatment Installation at Exterior Gypsum Sheathing Boards and Back of Parapet Boards:

1. Apply glass-fiber mesh tape to joints between boards.
2. Trowel apply air barrier membrane mastic over the top of glass-fiber mesh tape and at penetrations, openings, and edges where boards terminate at walls, floors, columns, or other structural elements.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall inspect first day's Work and periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, and instructions. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

3.6 PROTECTION

A. Procedures: Protect products and systems from damage during installation and remainder of construction period according to manufacturer's instructions. Remove and replace products that are exposed to weather for more than number of days allowed by manufacturer.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 06 4000

ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes architectural woodwork and supplementary items necessary to complete their installation.

B. Wood cabinets and casework are specified in Division 06 Section "Custom Casework".

C. Wood blocking concealed with other construction is specified in Division 06 Section "Rough Carpentry".

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, including finishing materials and processes.

1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show molding and trim details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

C. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, available for each type of material and finish indicated.

D. Samples for Verification: For the following:

1. Solid wood products transparent finish, 50 sq. in. or 12 inches long, for each species and cut, finished as specified.
2. Panel products 8 by 10 inches for each species and cut. Include at least one face seam and finish as specified.

E. Product Certificates: Signed by manufacturers of woodwork certifying that products furnished comply with requirements.

F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Fabricator Qualifications: A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. AWI Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.

1. Provide AWI certification labels or compliance certificate indicating that woodwork complies with requirements of grades specified.

D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL or ITS. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or imprint on surfaces of materials that will be concealed from view after installation.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, painting and wet-work is completed, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1. Comply with woodwork Quality Standard recommendation for optimum temperature and humidity conditions.
2. Do not install woodwork until conditions have been attained and stabilized.

B. Field Measurements: Where woodwork is indicated to be fitted to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on final shop drawings.
2. Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate other construction to ensure that actual dimensions correspond to established dimensions.

C. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. AWI Standard: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Fire-Retardant-Treated Material: Where indicated, use materials impregnated with fire-retardant chemical formulations by a pressure process to produce products with fire-test-response characteristics specified.

1. Do not use treated material that does not comply with requirements of referenced woodworking standard or that is warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
3. Comply with AWPA C20 (lumber) and AWPA C27 (plywood), Type A: Low-hygroscopic formulation for interior applications.

C. Wood Panel Products: Comply with the following:

1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
3. Particleboard: ANSI A208.1, Grade M-3, 47 lb. Density.
4. Softwood Plywood: DOC PS 1, Medium Density Overlay.
5. Hardwood Plywood and Face Veneers: HPVA HP-1.

D. Furring, Blocking and Shims: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

1. Fire-retardant-treated where used with fire retardant treated products.

E. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors.

2.2 FABRICATION, GENERAL

A. Woodwork Grade: Provide Premium Grade woodwork complying with the referenced quality standard unless otherwise indicated:

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges of solid wood members to radius indicated for the following:

1. Members 3/4-inch-thick or less: 1/16 inch.
2. Members more than 3/4-inch-thick: 1/8 inch.

D. Complete fabrication, including assembly and finishing, before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

2.3 STANDING AND RUNNING TRIM

A. Quality Standard: Comply with AWI Section 300.

B. Backout or groove backs of flat trim members and kerf backs of other wide flat members, except for members with ends exposed in finished work.

C. For trim items wider than available lumber, use veneered construction. Do not glue for width.

D. Wood Species and Finish:

1. As scheduled in Finish Legend.

2.4 FLUSH WOOD PANELING

A. Quality Standard: Comply with AWI Section 500 requirements for flush wood paneling.

B. Wood Species and Cut: As scheduled in Finish Legend.

C. Matching of Adjacent Veneer Leaves: Book match.

D. Vertical Matching of Adjacent Veneer Leaves: End match.

E. Veneer Matching within Panel Face: Balance match.

2.5 FINISHES

A. Preparations for Finishing:

1. Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
2. Backpriming: Apply one coat of sealer or primer compatible with finish coats to concealed surfaces of woodwork.

B. For Transparent Finish:

1. Factory Finish: Comply with AWI Section 1500, unless otherwise indicated.

a. AWI System TR-4 – Conversion Varnish.
b. Grade: Premium.
c. Stain: As selected from sample submittals.
d. Effect: Fully Filled if open grain.
e. Sheen: Satin, 30-40 gloss units.

2. Finish for concealed surfaces shall receive AWI standard.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION

A. AWI Quality Standard: Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.

B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for a complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Do not use pieces less than 36 inches long, except where necessary. Stagger joints in adjacent and related members.

F. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening, unless covered by trim.

1. Install flush paneling with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.

G. Complete the finishing work specified in this Section to the extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in the shop.

3.3 ADJUSTMENT AND CLEANING

A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean woodwork on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 07 1900

WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes penetrating water repellent, and supplementary items necessary to complete work required for its installation.

B. Refer to Division 03 Section "Cast-In-Place Concrete" for floor sealers and curing agents.

1.2 PERFORMANCE REQUIREMENTS

A. Provide water repellents with the following properties based on testing manufacturer's standard products, according to test methods indicated, applied to substrates simulating Project conditions using same materials and application methods to be used for Project.

1. Absorption: Minimum 90 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens, per ASTM C 642.
2. Water-Vapor Transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E 96.
3. Water Penetration and Leakage through Masonry: Maximum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, per ASTM E 514.
4. Durability: Maximum 5 percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, per ASTM G 53.
5. Permeability: Minimum 80 percent breathable in comparison of treated and untreated specimens, per ASTM D 1653.
6. Chloride-Ion Intrusion in Horizontal Concrete: Transportation Research Board, National Research Council's NCHRP Report 244, Series II tests.

    a. Reduction of Water Absorption: 80 percent.
    b. Reduction in Chloride Content: 80 percent.

1.3 SUBMITTALS

A. Product Data: Include manufacturer's specifications, surface preparation and application instructions, recommendations for water repellents for each surface to be treated, and protection and cleaning instructions. Include data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.

B. Applicator Certificates: Signed by manufacturer certifying that the applicator complies with requirements.

C. Certification by water repellent manufacturer that products supplied comply with local regulations controlling use of VOCs.

D. Material Test Reports: Indicate and interpret test results for compliance of water repellents with requirements indicated.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who employs only persons trained and approved by water repellent manufacturer for application of manufacturer's products.

B. Testing Agency Qualifications: An independent testing agency with experience and capability to conduct testing indicated in "Performance Requirements" Article without delaying the Work, per ASTM E 548.

C. Regulatory Requirements: Comply with applicable rules of pollution-control regulatory agency having jurisdiction in Project locale regarding VOCs and use of hydrocarbon solvents.

D. Field Samples: Select one representative surface for each substrate to receive water repellents. Apply water repellent to each substrate, with either partial or full coverage as directed. Comply with application requirements of this Section.

1. Obtain approval of field samples before applying water repellents.
2. Maintain field samples during construction in an undisturbed condition as a standard for judging the completed Work.

1.5 PROJECT CONDITIONS

A. Weather and Substrate Conditions: Do not proceed with application of water repellent under any of the following conditions, except with written instruction of manufacturer:

1. Ambient temperature is less than 40 deg F (4.4 deg C).
2. Concrete surfaces have cured for less than 28 days.
3. Rain or temperatures below 40 deg F (4.4 deg C) are predicted within 24 hours.
4. Application is earlier than 24 hours after surfaces have been wet.
5. Substrate is frozen or surface temperature is less than 40 deg F (4.4 deg C).
6. Windy condition exists that may cause water repellent to be blown onto vegetation or surfaces not intended to be coated.

1.6 WARRANTY

A. Special Warranty: Submit a written warranty, executed by the applicator and water repellent manufacturer, covering materials and labor, agreeing to repair or replace materials that fail to provide water repellency within the specified warranty period. Warranty does not include deterioration or failure of coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new joints and cracks in excess of 1/16 inch wide, fire, vandalism, or abuse by maintenance equipment.

1. Warranty Period: 5 years from date of Material Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Advanced Chemical Technologies.
2. Anti Hydro International, Inc.
3. Harris Specialty Chemicals, Inc.
4. L & M Construction Chemicals, Inc.

5. Nox-Crete Chemicals, Inc.
6. ProSoCo, Inc.
7. Textured Coatings of America

2.2 WATER REPELLENTS

A. Silane, 20 Percent Solids: Penetrating water repellent for vertical application. A monomeric compound containing approximately 20 percent alkyltrialkoxysilanes and meeting VOC/AIM regulations containing 3.3 lb./gal. VOCs or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates surfaces to receive water repellents and associated work and conditions under which work will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to Installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 PREPARATION

A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to repellent manufacturer's written instructions, to ensure surface is sufficiently dry.

B. Test for pH level, according to water repellent manufacturer's written instructions, to ensure chemical bond to silicate minerals.

C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass.

D. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.

E. Test Application: Before performing water-repellent work, including bulk purchase and delivery of products, prepare a small application in an unobtrusive location and in a manner approved by Architect to demonstrate the final effect (visual, physical, and chemical) of planned application. Proceed with work only after Architect approves test application or as otherwise directed.

3.3 APPLICATION

A. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.

1. Precast Work: At Contractor's option, first application of water repellent on precast concrete units may be completed before installing units. Mask sealant-bond surfaces to prevent water repellent from migrating onto joint surfaces.

B. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide services of a factory-authorized technical service representative to inspect and approve the substrate before application and to instruct the applicator on the product and application method to be used.

3.5 CLEANING

A. Protective Coverings: Remove protective coverings from adjacent surfaces and other protected areas.

B. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with manufacturer's written cleaning instructions.

3.6 SCHEDULE

A. Apply water repellents to following areas:

1. Cast stone.

END OF SECTION

SECTION 07 2100

THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Thermal insulation products and systems and supplementary items necessary for installation.

1.2 DEFINITIONS

A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control" Article.

C. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.

1.4 QUALITY ASSURANCE

A. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with minimum of 5 years experience in providing recommendations, observations, evaluations, and problem diagnostics. Sales representatives are not acceptable.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

a. Owner.
b. Architect.
c. Contractor, including superintendent.
d. Installer, including project manager and supervisor.
e. Manufacturer's qualified technical representative.
f. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

   a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
   b. Review Work requirements (Drawings, Specifications, and other Contract Documents).
   c. Review required submittals, both completed and yet to be completed.
   d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   e. Review required inspection, testing, certifying, and material usage accounting procedures.
   f. Review environmental conditions and procedures for coping with unfavorable conditions.
   g. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Provide product by one of manufacturers listed.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

B. General: Provide insulating materials that comply with requirements and referenced standards in sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths.

2.3 PERFORMANCE REQUIREMENTS

A. Plenum Rating: Provide fiberglass insulation to be installed within ceiling plenums rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or by comparable tests from another standard acceptable to authorities having jurisdiction.

1. Erosion Test Results: No visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500 fpm (13 m/s) air velocity.
2. Mold Growth and Humidity Test Results: No evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

B. Fire-Test-Response Characteristics:

1. Fire Resistance Ratings: Materials and construction identical to assemblies tested for fire resistance according to ASTM E 119/NFPA 251/UL 263 and included under Categories listed below that are published in Underwriters Laboratories, Inc. (UL) "Fire Resistance Directory"; or listing of another testing and inspecting agency acceptable to authorities having jurisdiction.

    a. Polystyrene Insulation: Category CCVW.
    b. Fiberglass Insulation: Category BZJZ

2. Surface Burning Characteristics: Materials and construction identical to assemblies tested for fire resistance according to ASTM E 84/NFPA 255/UL 723 by an independent testing and inspecting agency listed below. Identify products with appropriate markings of applicable testing agency.
3. Fire Rated Assembly Design: Selected from Product Category BXUV published in UL's "Fire Resistance Directory", or design of other testing agency acceptable to authorities having jurisdiction.
4. Combustion Characteristics: Materials and construction identical to assemblies tested for fire resistance according to ASTM E 136 by an independent testing and inspecting agency.

2.4 EXTRUDED POLYSTYRENE BOARD INSULATION

A. Description: Unfaced, rigid, cellular polystyrene thermal insulation formed from polystyrene base resin by an extrusion process, and with other requirements indicated below:

B. Product Quality Standard: ASTM C 578 of following type and minimum compressive strength for the following applications:

1. Backfilled Walls: Type IV, 25 psi (173 kPa).

C. Manufacturers and Products:

1. Type IV:

a. DiversiFoam Products; CertiFoam 25.
b. Dow Chemical Company; STYROFOAM Square Edge.
c. Owens Corning; FOAMULAR 250.
d. Pactiv Building Products Division; GreenGuard Type IV 25.

D. Surface Burning Characteristics:

1. Flame Spread: Class A - no greater than 25.
2. Smoke Developed: No greater than 200.

E. Thickness: As indicated but not less than 2 in (50 mm).

F. Adhesive for Bonding Insulation: Product compatible with insulation being bonded and with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation or substrates.

2.5 MASONRY CAVITY WALL INSULATION

A. Description: Glass-fiber-reinforced polyisocyanurate foam core with aluminum facers on both sides, and with other requirements indicated below:

B. Product Quality Standard: ASTM C 1289, Type I, Class 2; 25 psi minimum compressive strength.

C. Surface Burning Characteristics:

1. Flame Spread: Class A - no greater than 45.
2. Smoke Developed: No greater than 450.

D. Size: 2 in (50 mm) thick by 16 in (400 mm) high by 96 in (2400 mm) long, square edges.

E. Water Vapor Permeance: 0.03 maximum per ASTM E 96.

F. R-Value: 13.

G. Basis of Design: Dow Chemical Company; Thermax Exterior Insulation.

H. Adhesive for Bonding Insulation: Product compatible with insulation being bonded and with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation or substrates.

2.6 UNFACED FIBERGLASS SEMI-RIGID INSULATION

A. Description: ASTM C 612, Type IA or Types IA and IB. Unfaced, semi-rigid boards produced by bonding inorganic glass fibers with a thermosetting binder; free of formaldehyde.

B. Basis of Design: Knauf Insulation GmbH; Insulation Board with ECOSE Technology.

C. Nominal Density: 3 lb/cu ft (48 kg/cu m), thermal resistivity of 4.3 deg F x h x sq ft/Btu x in at 75 deg F (29.8 K x m/W at 24 deg C).

D. Surface-Burning Characteristics:

1. Flame Spread: Class A - no greater than 25.
2. Smoke Developed: No greater than 50.
3. Combustion Characteristics: Pass.

E. Thickness: As indicated but not less than 2 in (50 mm).

2.7 UNFACED FIBERGLASS BATT INSULATION

A. Description: ASTM C 665, Type I. Unfaced blankets produced by bonding inorganic glass fibers with a thermosetting binder; free of formaldehyde.

B. Basis of Design: Knauf Insulation GmbH; EcoBatt Insulation with ECOSE Technology.

C. Surface Burning Characteristics:

1. Flame Spread: Class A - no greater than 25.
2. Smoke Developed: No greater than 50.
3. Combustion Characteristics: Pass.

D. Thickness: As indicated..

2.8 SPRAYED FOAM INSULATING GAP FILLER

A. As specified in Division 07 Section "Joint Sealants".

2.9 POLYETHYLENE VAPOR-RETARDER MEMBRANE

A. Description: Fire-retardant reinforced polyethylene vapor-retarder membrane comprised of two outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either a non-woven grid of nylon cord or polyester scrim.

1. Minimum Physical Properties:

a. Weight: Minimum 22 lb per 1,000 sf (10 kg per 100 sm).
b. Vapor Permeance: 0.1317 perms (7.56 ng/Pa x s x sm) according to ASTM E 96, Procedure B.

B. Surface Burning Characteristics:

1. Flame Spread: Class A, no greater than 5.
2. Smoke Developed: Class A, no greater than 60.

C. Manufacturers and Products:

1. Raven Industries; Dura-Skrim 2FR.
2. Reef Industries, Inc., Griffolyn Type T-55 FR.

D. Accessories:

1. Sealing Tape: Asphalt based tape with double-sided adhesive and release liner provided by vapor-retarder manufacturer.

a. Manufacturers and Products:

1) Raven Industries; Butyl Seal Tape (TP2BR).
2) Reef Industries, Inc., Griffolyn Division; Fab Tape.

2. Seaming Tape: Pressure-sensitive tape for seaming and bonding joints and penetrations in vapor-retarder membrane provided by vapor-retarder manufacturer.

a. Manufacturers and Products:

1) Raven Industries; Vapor Bond Tape (TVB4).
2) Reef Industries, Inc., Griffolyn Division; Pressure Sensitive Tape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to which thermal insulation will be applied for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. General Requirements:

1. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, or snow.
2. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
3. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
4. Extend insulation full thickness to envelop entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.
5. Apply a single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF INSULATION SYSTEMS

A. Extruded Polystyrene Board Insulation: Install insulation according to following:

1. On vertical surfaces, set units in adhesive applied in accordance with manufacturer's written instructions and press in place to bond with substrate and, without forcing, in moderate contact between units.
2. On horizontal surfaces, set units with end joints staggered.
3. Seal joints between insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are put into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

B. Masonry Cavity Wall Insulation: Attach cavity wall insulation by placing beads of adhesive at 12 in (300 mm) on center both ways on inside face of insulation and pressing firmly against inside wythe of cavity. Fit insulation between veneer wall ties and other confining obstructions in cavity, with edges butted tightly.

C. Unfaced Fiberglass Semi-Rigid and Batt Insulation: Install insulation in cavities formed by framing members according to following:

1. Use insulation widths and lengths that fill the cavities formed by framing members. Where more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Where partition will be covered by gypsum board on only one side, apply adhesive to backside of gypsum board that is installed and press insulation in place to form bond to prevent insulation from sagging within cavity.

D. Sprayed Foam Insulating Gap Filler: As specified in Division 07 Section "Joint Sealants".

3.5 INSTALLATION OF POLYETHYLENE VAPOR-RETARDER MEMBRANES

A. General: Install multiple sheets to form continuously sealed polyethylene vapor retarder membrane at interior face of wall; maintain integrity throughout construction phase.

B. Installation: Install and attach over indicated substrates.

1. Before installing vapor-retarder, apply sealing tape to flanges of metal framing, including top and bottom runner tracks, metal studs, and framing around wall openings.
2. Pull vapor-retarder taut and press into sealing tape and firmly roll to enhance adhesion.
3. Locate vertical joints over steel studs or other solid substrates; lap not less than 2 wall studs and seal with seaming tape.
4. Ensure retarder integrity by sealing top, sides, and bottom edges to building structure with seaming tape; seal edges at perimeter of wall openings.
5. Seal joints and penetrations caused by pipes, conduits, electrical boxes, and similar penetrations with sealing tape.

6. Repair punctures, tears, voids, damage, and deficiently lapped seams by covering with seaming tape or another layer of retarder extending 6 in (150 mm) beyond damaged areas in each direction.

3.6 PROTECTION

A. Protection: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation

END OF SECTION

SECTION 07 2617

BELOW SLAB VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Below slab vapor retarders and supplementary items necessary for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, construction details, installation instructions, and recommendations for maintenance.

B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control" Article.

D. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.

E. Qualification Data: For installer.

1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer with not less than 5 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project site during times specified Work is in progress that is experienced in installing systems similar to type and scope required for Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

B. Mock-Ups: Prior to beginning Work of this Section, install minimum 150 sf (14 sq m) mock-up of below slab vapor retarder using materials indicated for the completed Work; incorporating subgrade construction, sealing at penetrations, and seaming to demonstrate installation of below slab vapor retarder system. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically accepted by Architect in writing. Apply mock-ups to set quality standards for materials and execution.

1. If Architect determines mock-up does not comply with requirements, reconstruct mock-ups until accepted.

1.4 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

a. Owner.
b. Architect.
c. Structural engineer.
d. Contractor, including superintendent.
e. Installer, including project manager and supervisor.
f. Manufacturer's qualified technical representative.
g. Installers of other construction interfaced with Work.
h. Testing agency.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, and installing the Work. Demonstration shall include, but not be limited to, the following topics:

a. Tour representative areas of Work, inspect and discuss substrate conditions, sequence of installation, and other preparatory work performed by other trades.
b. Review Work requirements (Drawings, Specifications, and other Contract Documents).
c. Review required submittals, both completed and yet to be completed.
d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
e. Review required inspection, testing, certifying, and material usage accounting procedures.
f. Review environmental conditions and procedures for coping with unfavorable conditions.
g. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.5 PROJECT CONDITIONS

A. Ambient Conditions: Install below slab vapor retarder within range of ambient and substrate temperatures and moisture conditions as recommended by manufacturer. Protect substrates from environmental conditions that affect performance. Do not apply to a damp or wet substrate or during high humidity conditions including snow, rain, fog, or mist.

1.6 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Provide product by one of manufacturers listed.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 BELOW SLAB VAPOR RETARDERS

A. Vapor Retarder for Typical Concrete Slab-on-Grade Conditions:

1. Product Quality Standard: ASTM E 1745, Class A, except water vapor permeance property shall not exceed 0.03 perms according to ASTM E 96, Method B.
2. Description: Prefabricated, flexible, lightweight material manufactured from raw or virgin polyethylene or polyolefin resins (post-consumer, recycled resins are not permitted); not less than 15 mil (0.4 mm) thick.
3. Manufacturers and Products:

    a. Fortifiber Building Product Systems; Moistop Ultra 15.
    b. Insulation Solutions, Inc.; Viper VaporCheck 16.
    c. W. R. Meadows, Inc.; Perminator, 15-mil.
    d. Raven Industries; VaporBlock 15.
    e. Reef Industries, Inc.; Griffolyn 15-mil Green.
    f. Stego Industries LLC; Stego Wrap, 15-mil.

B. Vapor Retarder for Concrete Slab-on-Grade Areas with Resinous Flooring:

1. Product Quality Standard: ASTM E 1745, Class A, except with following minimum physical properties:

    a. Water Vapor Permeance: Not more than 0.002 perms according to ASTM E 96, Method B.
    b. Tensile Strength: Not less than 156 lb (70.76 kg) per inch according to ASTM E 154, Section 9.
    c. Puncture Resistance: Not less than 149 lb (67.58 kg) according to ASTM E 154.

2. Description: Prefabricated, semi-flexible, material manufactured of multiple ply board composed of a proprietary core with bituminous impregnated material and glass-mat liners, with polyethylene facers.

3. Basis of Design: W. R. Meadows, Inc.; Premoulded Membrane Vapor Seal with Plasmatic Core (PMPC).

2.4 ACCESSORIES

A. Barrier Seaming and Sealing Tape: Manufacturer's standard one-sided or two-sided pressure-sensitive tape of type, material and size for sealing membrane joints and for sealing membrane to other adjacent structures; provided by vapor retarder manufacturer.

B. Penetration Accessories: Manufacturer's standard pre-molded products or mastic for sealing penetrations; provided by vapor retarder manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine subgrade and foundation surfaces to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:

1. ASTM E 1643, except place vapor retarder on top of granular fill.
2. Respective manufacturer's installation written instructions.
3. Accepted submittals.
4. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and Project specifications for subgrade preparation. Subgrade surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work. Provide smooth, level, and properly compacted and moisture conditioned subgrade in accordance with Geotechnical Engineer's recommendations.

B. Ensure that subgrade is smooth and even without sharp or protruding objects that might rip, tear, or puncture vapor retarder membrane.

3.4 BELOW SLAB VAPOR RETARDER INSTALLATION

A. Install multiple sheets to form continuously sealed below slab vapor retarder over properly prepared subgrade prior to concrete slab reinforcing installation.

1. Place vapor retarder membrane in widest width possible over subgrade with longest dimension parallel with direction of concrete placement with proper face toward concrete; pull taut to eliminate fishmouths, wrinkles, buckles, and kinks.

2. Properly dry and clean mating surfaces of vapor retarder membrane prior to application of seaming tape.
3. Overlap sides and ends of vapor retarder membrane not less than 6 in (150 mm) and apply seaming tape.
4. Ensure vapor retarder membrane is continuous from edge to edge of concrete slab according to following:

    a. Place membrane on top of footings and "roll-up" onto vertical surfaces and apply seaming tape to hold membrane in place.
    b. Extend membrane out from under edges of concrete slab minimum of 2 in (50 mm) to demonstrate continuity.

5. Cut vapor retarder membrane carefully around penetrations and seal with either premolded accessories, or on-site collar fabrications using seaming tape or mastic; if field fabricated, comply with manufacturer's recommended details.
6. Repair rips, tears, or punctures with seaming tape, or by cutting out damaged areas and patching with new vapor retarder membrane, overlapping damaged area minimum 6 in (150 mm) in each direction and apply seaming tape.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall inspect first day's Work and periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

B. Inspection of In-Progress Work: Employ a qualified independent inspection agency to perform the following inspections for field quality control. Re-inspections of materials failing to meet specified requirements shall be done at Contractor's expense.

1. Prior to beginning concrete slab reinforcing installation, inspect vapor retarder membrane for rips, tears, and punctures.
2. Prior to concrete placement work, inspect concrete installer's tools and notify Contractor to have tools with spikes or other sharp surfaces that could inflict intentional or unintentional damage on the installed vapor retarder membrane removed from work area.
3. Immediately prior to concrete placement work, inspect vapor retarder membrane for rips, tears, and punctures, inspect penetrations at columns and mechanical and electrical piping.
4. Continuously inspect concrete placement work, watching for damage to vapor retarder membrane.
5. Periodically inspect portions of slab that were not placed (block-outs, voids, and leave-outs) for water infiltration of subgrade until concrete is subsequently placed.

3.6 PROTECTION

A. Protection during Concrete Work: Ensure vapor retarder membrane will be without damage or deterioration during in-place fabrication of concrete slab reinforcing and subsequent placement of concrete.

1. Prevent vehicles from driving over vapor retarder membrane once it has been placed.
2. Prevent wood or steel stakes from penetrating vapor retarder membrane.
3. At locations where portions of slab are not placed (block-outs, voids and leave-outs), provide protection to prevent water infiltration into void that would contaminate subgrade below vapor retarder membrane; maintain until concrete is subsequently placed.

END OF SECTION

SECTION 07 2726

FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fluid-applied membrane air barrier within exterior wall assemblies and accessories necessary to complete installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical product literature for each product indicated, specified, or required.

1. Include manufacturer's installation instructions.
2. Include manufacturer's standard detail drawings for attachment, lapping, openings, penetrations, corners, and other conditions encountered.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Company experienced in performing specified Work similar to scope of this Project, and with a record of successful in-service.
2. Supervision: Installer shall maintain a competent supervisor who is at Project during times specified Work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.
3. Manufacturer Training: Technical representatives of manufacturer shall train Installer's installation personnel (supervisor and installers) at Project, on following:

a. Proper installation of products.
b. Proper sequence of installation of Work.
c. Situations that require special attention or care during installation.
d. Situations and conditions that should be avoided.
e. Other topics relevant to installation.

B. Mock-Ups: Before beginning Work of this Section, install minimum 150 sq ft (14 sq m), mock-up of exterior wall assembly, incorporating backup wall construction, exterior cladding, window and door openings, and flashing to demonstrate installation of air barrier.

1. If Architect determines mock-up does not comply with requirements, reconstruct mock-ups until approved.
2. Approved mock-ups may become part of completed Work if undisturbed at time of substantial completion.

C. Pre-Installation Conference: Before beginning Work of this Section, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

a. Owner.
b. Architect.
c. Contractor, including supervisor.
d. Air barrier installer, including supervisor.
e. Installers of other Work, including supervisors, connecting to air barrier, including roofing, waterproofing, exterior cladding, sealants, windows, glazed aluminum walls, and door frames.
f. Manufacturer's technical representative.

2. Minimum Agenda: Installer shall demonstrate understanding of Work required by reviewing and discussing procedures including, but not limited to, following:

a. Tour mock-up and representative areas of required Work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, sequence of installation, and other preparatory Work performed by other installers.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Installation procedures, including but not limited to:

1) Sequence of installation.
2) Surface preparation.
3) Evaluating substrate conditions.
4) Attachment and lapping of sheets.
5) Treatment at openings, penetrations, and corners.
6) Repairs to damaged products.
7) Other conditions encountered.

e. Review forecasted weather conditions and procedures for coping with winds and other unfavorable conditions.

3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.4 PROJECT CONDITIONS

A. Ambient Conditions: Install air barrier within range of ambient and substrate temperatures recommended by manufacturer. Do not install to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Provide product by one of manufacturers listed below.

2.2 AIR BARRIER

A. Fluid-Applied Membrane Air Barrier:

1. Description: Seamless, water-based, fully adhered air barrier, spray- or roll-applied to a minimum of 60 mils (1.5 mm) wet film thickness using multiple, overlapping passes.
2. Minimum Physical Properties:

a. Membrane Air Permeance: Not to exceed 0.004 cu ft/min/sq ft (0.02 L/s/sq m) of surface area at 1.57 lbf/sq ft (7.66 kg/sq m) pressure difference according to ASTM E 2178.
b. Ultimate Elongation: 1500 percent minimum according to ASTM D 412, Die C, modified.
c. Low-Temperature Flexibility: Pass at minus 20 deg F (29 deg C); according to ASTM C 836.
d. Vapor Permeance: Min. 12.0 perms according to ASTM E 96, Procedure B.

3. Acceptable Manufacturer and Product:

a. Tremco Commercial Sealants & Waterproofing; ExoAir 220.
b. Henry Company; Airbloc 31.

2.3 ACCESSORIES

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid waterborne primer recommended for substrate by manufacturer of air barrier material.

C. Counterflashing Strip: Modified bituminous, 40-mil- (1.0-mm-) thick, self-adhering sheet consisting of 32 mils (0.8 mm) of rubberized asphalt laminated to an 8-mil- (0.2-mm-) thick, crosslaminated polyethylene film with release liner backing.

D. Modified Bituminous Strip: Vapor-retarding, 40-mil- (1.0-mm-) thick, smooth-surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick polyethylene film with release liner backing.

E. Joint Reinforcing Strip: Air barrier manufacturer's glass-fiber-mesh tape.

F. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

G. Adhesive and Tape: Air barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

H. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch (0.5 mm) thick, and Series 300 stainless-steel fasteners.

I. Modified Bituminous Transition Strip: Vapor-retarding, 40-mil- (1.0-mm-) thick, smooth-surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick polyethylene film with release liner backing.

J. Termination Bars:

1. Bar: 1/8 in (3 mm) thick by 1 in (25 mm) wide continuous stainless steel bar with [1/4 in (6 mm)] diameter holes spaced at [16 in (400 mm)] on centers.
2. Screws: Corrosion resistant, self-tapping drill point screws with hex washer head with bonded EPDM, shank size and length as required to penetrate steel stud flange by not less than 3 exposed threads.

K. Sprayed Foam Sealant: Foamed-in-place polyurethane foam sealant specified in Division 07 Section "Building Insulation."

L. Joint Sealant: Silicone construction sealant specified in Division 07 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrate surfaces to which air barriers will be placed for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as acceptance.

3.2 PREPARATION

A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and vapor retarder manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.

1. Prime substrate and apply a single thickness of preparation coat strip extending a minimum of 3 inches (75 mm) along each side of joints and cracks. Apply a double thickness of vapor retarder membrane and embed a joint reinforcing strip in preparation coat.

B. Gypsum Sheathing: Fill joints greater than 1/4 inch (6 mm) with sealant according to ASTM C 1193 and with air barrier manufacturer's written instructions. Apply first layer of fluid air barrier membrane at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air barrier membrane over joint reinforcing strip.

3.4 INSTALLATION, GENERAL

A. Installation Performance Requirements: Ensure air barrier isolates building interiors from moisture vapor diffusion and air and water infiltration through exterior walls.

B. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's installation instructions.
2. Approved submittals.
3. Contract Documents.

3.5 TRANSITION STRIP INSTALLATION

A. Install strips, transition strips, and auxiliary materials according to vapor retarder manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of vapor retarder with roofing membrane.
2. Install modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier and flashing sheet in same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane vapor retarder, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials as indicated.

D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply modified bituminous transition strip so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.

1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.

G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

H. Seal top of through-wall flashings to air barrier with an additional 6-inch- (150-mm-) wide, modified bituminous strip.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.6 AIR BARRIER MEMBRANE INSTALLATION

A. Apply air barrier membrane to form a seal with strips and transition strips and to achieve a continuous air barrier according to vapor retarder manufacturer's written instructions.

B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.

C. Apply a continuous unbroken air barrier to substrates a minimum wet film thickness of 60-mil (1.5-mm). Apply membrane in full contact around protrusions such as masonry ties.

D. Apply strip and transition strip a minimum of 1 inch (25 mm) onto cured membrane according to air barrier manufacturer's written instructions.

E. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

F. Correct deficiencies in or remove vapor retarder that does not comply with requirements; repair substrates and reapply air barrier components.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative, not a sales representative, shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's instructions and warranty requirements. Representative shall submit written report of each visit indicating observations, findings and conclusions of inspection.

3.8 PROTECTION

A. Procedures: Protect air barriers from damage during installation and remainder of construction period, according to manufacturer's instructions. Remove and replace air barriers exposed to sunlight for more than number of days allowed by manufacturer.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 07 4243

COMPOSITE METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes composite metal wall panel and supplementary items necessary to complete their installation.

1.2 SYSTEM DESCRIPTION

A. This is a performance specification and wall system manufacturer shall be responsible for complete design and engineering required to meet specified performance requirements within physical and aesthetic requirements established.

B. Drawings and specifications are an outline of criteria and performance requirements for the System. Requirements specified or indicated by details are intended to establish basic dimensions of module and sight lines and profiles of members. Include modifications or additions required to meet specified requirements and maintain the visual design concept.

C. Contract Documents do not necessarily indicate or describe total work required for completion of Work. Furnish and install all items required for complete installation.

D. Dimension and profile adjustments may be made in proposed design in interest of fabrication or erection methods or techniques, weatherability factor, or ability of design to satisfy design and performance requirements, provided that design intent and intent of Contract Documents are maintained.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide composite metal wall panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sq. ft.

C. Water Penetration: No water penetration when tested according to the following standards at a minimum pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. and not more than 12 lbf/sq. ft.

1. Static Pressure: ASTM E 331.
2. Dynamic Pressure: AAMA 501.1.
3. Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

D. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330.

1. Wind Loads: Determine loads based on minimum design wind pressures acting inward or outward as indicated under Building Summary on the Drawings.
2. Deflection Limits: Engineer metal wall panel assemblies to withstand test pressures with following maximum deflection and no evidence of material failure, structural distress, or permanent deformation exceeding 0.2 percent of the clear span.

    a. Test Pressures: 150 percent of inward and outward wind-load design pressures.
    b. Maximum Deflection: 1/175 of the span for perimeter framing members.
    c. Maximum Deflection: 1/60 of the span for individual panels.
    d. Design system to accommodate 3/8 inch differential vertical live load movement of the floors.

E. Seismic Performance: Provide metal wall panel assemblies capable of withstanding the effects of earthquake motions determined according to applicable code requirement and Building Summary on Drawings.

F. Thermal Movements: Provide composite wall panel assemblies that allow for noiseless thermal movements resulting from range in ambient temperatures of minus 20 to plus 180 deg F and that prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.

G. Infiltrated and Condensation Water Management: System design shall incorporate provisions for guttering and weeping infiltrated and condensate water out of system to the exterior. Coordinate with other adjacent exterior wall components.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal wall panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

1. For installed products indicated to comply with design loads, include shop drawings signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Verification: Provide sample panels 6 inch x 6 inch, in the color, and texture indicated. Include clips, caps, battens, fasteners, closures, and other exposed panel accessories.

D. Product Test Reports: Indicate compliance of wall panel assemblies and materials with performance and other requirements based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed metal wall panel projects similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Certified by composite metal panel manufacturer to fabricate and install manufacturer's wall panel system.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services of the kind indicated.

D. Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 with the experience and capability to conduct the testing indicated without delaying the Work, as documented according to ASTM E 548.

E. Sample Mock-Up: Provide 18 inch by 18 inch sample mock-up of typical horizontal and vertical paneljoint intersection with attachment condition and seaslant. Include sample mock-up of any unusual condition.

F. Site Mock-ups: Before installing wall panels, construct mock-ups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-ups to comply with the following requirements, using exposed and concealed materials indicated for the completed Work.

1. Locate mock-ups in the location and of the size indicated or, if not indicated, a minimum of 4 typical size panels.
2. Notify Architect 7 days in advance of the dates and times when mock-ups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mock-ups before proceeding with construction of wall panels.
5. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Approved mock-ups in an undisturbed condition at the time of Material Completion may become part of the completed Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage in accordance with manufacturer's recommendations.

C. Store composite wall panels vertically, covered with suitable weathertight and ventilated covering. Store panels to ensure dryness, with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 deg F.

D. Protect strippable protective covering on metal wall panels from exposure to sunlight and high humidity, except to extent necessary for period of metal wall panel installation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify location of structural members and openings in substrates by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish opening dimensions and proceed with fabricating wall panels without field measurements or allow for trimming panel units. Coordinate wall construction to ensure actual locations of structural members and to ensure opening dimensions correspond to established dimensions.

1.8 WARRANTY

A. Special Finish Warranty: Submit a written warranty, signed by manufacturer, covering failure of the factory-applied exterior finish on metal wall panels within the specified warranty period and agreeing to repair finish or replace wall panels that show evidence of finish deterioration. Deterioration of finish includes, but is not limited to, color fade, chalking, cracking, peeling, and loss of film integrity.

B. Finish Warranty Period: 20 years from date of Material Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Alcan Composites, Inc.
2. Citadel Architectural Products.
3. Copper Sales, Inc.
4. Reynolds Metals Co.
5. Mitsubishi Chemical America Inc.

B. Product Standard: Alcan Composites USA, Inc. – "Alucobond".

1. System: Rout and Return Wet Seal.

2.2 PANEL FABRICATION

A. Composition: Two sheets of aluminum sandwiching a solid core of extruded thermoplastic material formed in a continuous process with no glues or adhesives between dissimilar materials. The core material shall be free of voids and/or air spaces and not contain foamed insulation material. Products laminated sheet by sheet in a batch process using glues or adhesives between materials shall not be acceptable.

1. Coil-Coated Aluminum Face Sheets: ASTM B 209, 0.020-inch-thick, AA3003 aluminum alloy.
2. Panel Thickness and Weight: 4mm (0.157 inch), 1.12 lbs./sq. ft.

B. Tolerances

1. Panel Thickness: Plus or minus 0.008 inches.
2. Panel Squareness: 0.2 inch maximum.
3. Panel Bow: Maximum 0.8 percent of panel dimension in width and length.
4. Panel Flatness: 1/8 inch in 60-inch-panel in any direction for assembled units. (non-accumulative)

C. System Characteristics: Plans, elevations, details, characteristics, and other requirements indicated are based upon standards by one manufacturer. It is intended that other listed manufacturers, are acceptable, provided their details and characteristics comply with size and profile requirements, and material/performance standards specified.

1. System must provide a wet seal (caulked) reveal joint or an aluminum extrusion with integral weatherstripping as indicated.
2. System shall incorporate a route and return joint system and must not generally have any visible fasteners, telegraphing or fastening on the panel faces or any other compromise of a neat and flat appearance.

3. Fabricate panel system to dimension, size, and profile indicated on the drawings based on a design temperature of 70 deg F.
4. Fabricate panel system so that no restraints can be placed on the panel which might result in compressive skin stresses. The installation shall be such that the panels remain flat regardless of temperature change and at all times remain air and water tight.
5. Field fabrication shall be allowed where necessary, but shall be kept to an absolute minimum. All fabrication shall be done under controlled shop conditions to greatest extent possible.
6. Panel lines, breaks, and angles shall be sharp, true, and surfaces free from warp and buckle.
7. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.
8. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
9. The finish side of the panel shall have a removable plastic film applied prior to fabrication which shall remain on the panel during fabrication, shipping, and erection to protect the surface from damage.

2.3 ACCESSORIES

A. Extrusions, formed members, sheet, and plate shall conform to ASTM B 209 and the recommendations of the manufacturer.

B. Panel stiffeners, if required, shall be structurally fastened or restrained at the ends and shall be secured to the rear face of the composite panel with silicone of sufficient size and strength to maintain panel flatness. Stiffener material and/or finish shall be compatible with the silicone.

C. Exposed sealants at panel joint connections and perimeter shall comply with requirements specified in Division 07 Section "Joint Sealants".

D. Sealants and gaskets within the panel system shall be as per manufacturer's standards to meet performance requirements.

E. Fabricate flashing materials from 0.030 inch minimum thickness aluminum sheet painted to match the adjacent panel system where exposed. Provide a lap strap under the flashing at abutted conditions and seal lapped surfaces with a full bed of non-hardening sealant.

F. Fasteners as recommended by panel manufacturer. Do not expose fasteners except where unavoidable and then match finish of adjoining metal.

G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

H. Panel Supports and Anchorage: Provide girts, furring channels, angles, plates, bracing, and other secondary framing members complying with ASTM C 645 requirements for metal and ASTM A 653, G40 hot-dip galvanized zinc coating.

1. Subgirts: C- or Z-shaped sections fabricated from 0.0598-inch- base steel thickness, galvanized cold formed steel sheet.
2. Hat-Shaped Furring Channels: Fabricated from 0.0312-inch- base metal thickness, galvanized.

2.4 FINISHES

A. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

C. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 620.
2. Color and Gloss: AF-1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements indicated for conditions affecting performance of metal panel walls.

1. Panel Supports and Anchorage: Examine wall framing to verify that girts, angles, and other secondary structural panel support members and anchorage have been installed to meet requirements of panel manufacturer.
2. Do not proceed with wall panel installation until unsatisfactory conditions have been corrected.
3. Starting work within a particular area will be construed as applicator's acceptance of substrate conditions.

3.2 PREPARATION

A. Coordinate metal wall panels with flashing; trim; and construction of other adjoining work to provide a leakproof, secure, and noncorrosive installation.

B. Promptly remove protective film from exposed surfaces of metal panels. Strip with care to avoid damage to finish.

C. Secondary Structural Supports: Install girts, angles, and other secondary structural panel support members and anchorage.

3.3 PANEL INSTALLATION

A. General: Comply with panel manufacturer's written instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.

B. Attachment system shall allow for the free and noiseless vertical and horizontal thermal movement due to expansion and contraction of material. Buckling of panels, opening of joints, undue stress on fasteners, failure of sealants or any other detrimental effects due to thermal movement will not be permitted. Fabrication, assembly, and erection procedure shall account for the ambient temperature at the time of the respective operation.

C. Anchor panels securely per manufacturer's recommendations and in accordance with approved shop drawings to allow for necessary thermal movement and structural support.

D. Conform to panel fabricator's instructions for installation of concealed fasteners.

E. Do not install component parts which are defective, including warped, bowed, dented, abraised, and broken members.

F. Do not cut, trim, weld, or braze component parts during erection in a manner which would damage the finish, decrease strength, or result in visual imperfection or a failure in performance. Return component parts which require alteration to shop for refabrication, if possible, or for replacement with new parts.

G. Joint Sealers: Install gaskets, joint fillers, and sealants where required for weatherproof performance of wall panel assemblies. Provide types of gaskets, fillers, and sealants recommended by panel manufacturer.

1. Install weatherseal to prevent air and moisture penetration. Flash and seal panels at ends and intersections with other materials with rubber, neoprene, or other closures to exclude weather.
2. Prepare joints and apply sealants to comply with requirements of Division 07 Section "Joint Sealants."

H. Separate dissimilar metals by painting each metal surface in area of contact with a bituminous coating or by other permanent separation as recommended by manufacturers of dissimilar metals.

I. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.4 CLEANING AND PROTECTING

A. Damaged Units: Replace panels and other components of the Work that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

B. Cleaning: Remove temporary protective coverings and strippable films, as soon as each panel is installed. On completion of panel installation, clean finished surfaces as recommended by panel manufacturer and maintain in a clean condition during construction.

END OF SECTION

SECTION 07 6113

STANDING SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this Section includes factory formed standing seam metal roof panels, roof insulation, and supplementary items necessary to complete their installation.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide metal roof panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 283 at the following test-pressure difference:

1. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
2. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

C. Water Penetration: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
2. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift resistance class indicated.

E. FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

1. Fire/Windstorm Classification: Class 1A 90.

F. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:

1. Wind Loads: Determine loads based on minimum design wind pressures as indicated on drawings acting inward or outward.

G. Seismic Performance: Provide metal roof panel assemblies capable of withstanding the effects of earthquake motions determined according to applicable local code requirements.

H. Thermal Movements: Provide metal roof panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.3 SUBMITTALS

A. Product Data: Submit including construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal roof panel and accessory.

B. Shop Drawings: Submit showing fabrication and installation layouts of metal roof panels; details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

1. For installed products indicated to comply with design loads, include shop drawings signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Verification Purposes: Submit for each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Roof Panels: 12 inches long by actual panel width. Include fasteners, clips, closures, and other metal roof panel accessories.
2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch-long Samples for each type of accessory.

D. Product Test Reports: Submit based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:

1. Metal Roof Panels: Include reports for air infiltration, water penetration and structural performance.

E. Maintenance Data: Submit for metal roof panels to include in maintenance manuals.

F. Warranties: Submit special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

1. Installer's responsibilities include fabricating and installing metal roof panel assemblies and providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of data for metal roof panels, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain each type of metal roof panels through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal roof panels and are based on the specific system indicated.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Mock-up: Build mock-up to verify selections made under sample Submittals and to demonstrate aesthetic effect and qualities of materials and execution.

1. Build mock-up of typical roof eave as shown on Drawings; approximately 48 inches square by full thickness, including insulation, underlayment, attachments, and accessories.
2. Approval of mock-up is for other material and construction qualities specifically approved by Architect in writing.
3. Approval of mock-up does not constitute approval of deviations from the Contract Documents contained in mockup unless such deviations are specifically approved by Architect in writing.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal roof panel Installer, metal roof panel manufacturer's representative, deck Installer, and installers whose work interfaces with or affects metal roof panels including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal roof panel installation, including manufacturer's written instructions.
4. Examine deck substrate conditions for compliance with requirements, including flatness and attachment to structural members.
5. Review structural loading limitations of deck during and after roofing.
6. Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
8. Review temporary protection requirements for metal roof panel assembly during and after installation.
9. Review roof observation and repair procedures after metal roof panel installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roof panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of roof framing and roof opening dimensions by field measurements before metal roof panel fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal roof panels without field measurements, or allow for field-trimming of panels. Coordinate roof construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and applicator agree to repair or replace components of metal roof panel assemblies that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of Material Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Material Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Material Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. AEP-Span.
2. Architectural Building Components.
3. Berridge Manufacturing Co.
4. Centria Roof Systems.
5. Copper Sales, Inc.
6. Metal Building Components, Inc.
7. PAC-CLAD Petersen Aluminum Corp.

B. Basis-of-Design Product Standard: The design for each metal roof panel specified is based on the manufacturer and product named. Provide either the named product or a comparable product by one of the other acceptable manufacturers listed.

2.2 METAL PANEL MATERIALS

A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation; structural quality.
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Class AZ50 coating designation, Grade 40; structural quality.
3. Surface: Smooth, flat finish.

4. Exposed Finish: Apply coil coating of high performance organic coating. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

    a. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2605.
    b. Color: AF-1.

5. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.3 THERMAL INSULATION

A. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type II (asphalt felt or glass-fiber mat facing), with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core.

1. Provide insulation thickness required to maintain an aged R-value of 19.

2.4 UNDERLAYMENT MATERIALS

A. Rubberized Asphalt Underlayment:

1. Product Quality Standard: ASTM D 1970.
2. Description: Minimum 40 mils thick, cold applied, self-adhering sheet consisting of slip-resisting polyethylene-film reinforcing and top surface laminated to rubberized asphalt adhesive, with release-paper backing.
3. Surface Primer / Conditioner: Product as provided by underlayment manufacturer.
4. Acceptable Manufacturers and Products:

    a. Carlisle Coatings & Waterproofing Inc.; CCW-WIP-400.
    b. Grace, W. R. & Co.; Ice and Water Shield.
    c. Henry Co.; Blueskin RF200.
    d. Polyguard Products, Inc.; Deck Guard.
    e. Protecto Wrap Co.; Rain-Proof TM.

B. Slip/Separation Sheet: Building paper of type, composition, and weight recommended by metal roof panel metal manufacturer.

2.5 ROOF COVER BOARDS

A. Roof Cover Boards: ASTM C 1177 / C 1177M, Type X.

1. Description: Glass-mat faced exterior gypsum sheathing board specifically manufactured for use beneath roofing systems. Non-combustible moisture-resistant gypsum core with glass-mat facings; minimum 5/8 in (15 mm) thick. Provide in maximum lengths and widths available that will minimize short-edge-to-short-edge butt joints and to correspond to support system indicated.
2. Basis of Design: Georgia-Pacific Gypsum LLC; DensDeck Prime or DuraGuard; Fireguard Type X Sheathing; as recommended by metal roof panel assembly manufacturer.

B. Screw Fasteners:

1. Material Quality Standards: ASTM C 954, Type S-12.
2. Product Description: Bugle head, self-drilling, self-tapping, stainless steel screws with Phillips-head recess of size, holding power, and other properties recommended by manufacturer; minimum 1 in (25 mm) long.

2.6 MISCELLANEOUS METAL FRAMING

A. General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with ASTM A 653, G60, hot-dip galvanized zinc coating.

B. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.7 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating.

1. Fasteners for Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.8 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be field assembled by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

B. Seamed-Joint, Metal Roof Panels: Formed with vertical ribs at panel edges and flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and mechanically seaming panels together.

1. Material: Zinc-coated (galvanized) or Aluminum –zinc alloy coated steel sheet, 0.0209-inch-thick.
2. Clips: Manufacturer's standard floating type to accommodate thermal movement, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, designed to meet wind uplift.
3. Joint Type: Single or Double folded as standard with manufacturer.
4. Panel Coverage: 16 inches.
5. Panel Height: 2.0 inches.
6. Product Standard: Centria; SDP200 Structural Design Panel.
7. Pan Design: Pencil bead.
8. Approved Minimum Slope: 1:12 with end laps.

2.9 ACCESSORIES

A. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels, unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Formed from 0.0179-inch-thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, soffits, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

2.10 FABRICATION

A. General: Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate metal roof panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.

C. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material and thickness as accessory being anchored or from compatible, noncorrosive metal recommended by metal roof panel manufacturer.

2.11 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of work.

B. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

C. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

B. Install flashings and other sheet metal to comply with requirements and recommendations in SMACNA'S "Architectural Sheet Metal Manual".

C. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written recommendations.

3.3 INSULATION INSTALLATION

A. Coordinate installing metal roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with insulation manufacturers written instructions for installing roof insulation.

C. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

D. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

E. Install insulation with through screws and roofing bearing plate, spaced 24 inches o.c., maximum.

3.4 ROOF COVER BOARD INSTALLATION

A. General: Comply with FMG and metal roof panel assembly manufacturer's written instructions for installing roof cover boards. Securely attach roof cover boards to zee purlins with fasteners spaced in accordance with metal roof panel manufacturer's written instructions to meet requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.

B. Install roof cover boards over entire roof surface. Install boards with panel lengths oriented perpendicular to roof slope with edges centered over flanges of zee purlins, with edges and ends butted together. Offset joints of insulation below a minimum of 6 in (150 mm) in each direction.

C. Fit boards tightly against abutting construction, except provide maximum 3/8 in (10 mm) setback where boards abuts structural elements or materials that may retain moisture.

D. Install screws so screw heads bear tightly against board face but do not cut into facing.

E. Coordinate installation of roof cover boards with underlayments so materials are installed in the sequence and manner that prevent exterior moisture from passing through completed assembly.

3.5 UNDERLAYMENT INSTALLATION

A. Rubberized Asphalt Underlayment: Apply on substrates to be covered by metal roof panels according to manufacturer's instructions.

1. Apply primer if required by manufacturer.
2. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installations at low temperatures.
3. Apply wrinkle free, in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller.
4. Apply over entire roof surface from eave to ridge.
5. Cover underlayment with metal roof panels within 14 days of application.

B. Slip/Separation Sheet: Apply over underlayment before installing metal roof panels.

3.6 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cutting of metal roof panels by torch is not permitted.
2. Install panels perpendicular to purlins.
3. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels.
4. Provide metal closures where panels terminate.
5. Flash and seal metal roof panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
6. Locate and space fastenings in uniform vertical and horizontal alignment.
7. Install ridge and hip caps as metal roof panel work proceeds.
8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
9. Lap metal flashing over metal roof panels to allow moisture to run over and off the material.

B. Fasteners: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.

1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

E. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.

1. Install clips through bearing plates with self-tapping fasteners.
2. Install anchor plates at locations indicated in manufacturer's written installation instructions.
3. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

F. Fascia Panels: Align bottom of panels and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.7 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.8 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.

3.9 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.

3.10 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 6200

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Flashing and sheet metal including assemblies listed below along with supplementary items necessary for installation:

1. Roof-edge drainage systems.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring flashing and sheet metal trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details showing interface and relationship to adjacent materials.
5. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
6. Details of termination points and assemblies, including fixed points.
7. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples for Verification Purposes: Submit for items listed below; provide samples made from 12 in (300 mm) lengths of full-size components including fasteners, cover joints, accessories, and attachments.

1. Roof-edge drainage systems.

D. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

E. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control" Article.

F. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

G. Qualification Data: For shop-fabricator and installer.

1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.

H. Warranty: Sample of warranty.

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

I. Maintenance Data: To include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Shop-Fabricator Qualifications: Manufacturer/fabricator with not less than 5 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years, and with sufficient production capability, facilities, and personnel to produce required Work.

B. Installer Qualifications:

1. Experience: Installer with not less than 5 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project site during times specified Work is in progress that is experienced in installing systems similar to type and scope required for Project.

C. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

D. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with minimum of 5 years experience in providing recommendations, observations, evaluations, and problem diagnostics. Sales representatives are not acceptable.

E. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.

2. Clean exposed faces of mock-up.
3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Protect accepted mock-up from the elements with weather-resistant membrane.

6. Obtain Architect's acceptance of mock-ups before starting fabrication.
7. Maintain mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.
8. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and accepted by Architect in writing.
9. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.4 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

a. Owner.
b. Architect.
c. Contractor, including superintendent.
d. Installer, including project manager and supervisor.
e. Manufacturer's qualified technical representative.
f. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Work requirements (Drawings, Specifications, and other Contract Documents).
c. Review required submittals, both completed and yet to be completed.
d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
e. Review required inspection, testing, certifying, and material usage accounting procedures.
f. Review environmental conditions and procedures for coping with unfavorable conditions.
g. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing materials and fabrications away from uncured concrete and masonry.

D. Protect strippable protective covering on sheet metal flashing materials and fabrications from exposure to sunlight and high humidity, except to extent necessary for the period of installation.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit flashing and sheet metal work to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.8 WARRANTY

A. Installer's Warranty: Furnish installer's written warranty signed by an authorized representative using installer's standard form agreeing to repair or replace components of sheet metal flashing system installed integrally with the roofing system which exhibit defects in materials or workmanship within specified warranty period. "Defects" is defined to include, but not limited to, deterioration or failure to perform as required.

1. Warranty Period: 2 years from date of Material Completion.

B. Factory Applied Finish Warranty: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.

1. Coverage includes but is not limited to the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 20 years from date of Material Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Provide product by one of manufacturers listed.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Installed sheet metal flashing materials and fabrications shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Sheet metal flashings shall remain watertight.

B. Design Loads: Installed sheet metal flashing materials and fabrications shall withstand design loads including, but not limited to, requirements established by authorities having jurisdiction, applicable local building codes, and as indicated. Contractor shall obtain required design data and identify requirements accommodated on submittal drawings.

C. Material Compatibility: Provide flashing and sheet metal materials that are compatible with one another and specified roofing system under conditions of service and application required, as demonstrated by manufacturer based on testing and field experience.

D. Delegated Design: Design roof edge flashing assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

E. Edge Systems Design: Provide edge systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to SPRI's "Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems" ES-1.

F. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

2.4 METAL FLASHING MATERIALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209 / B 209M, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

1. Surface: Smooth and flat.
2. Surface: Embossed.
3. Thickness: 0.025 in (24 gage) (0.64 mm) minimum thickness.
4. Exposed Coil-Coated Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

    a. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent polyvinyl di-fluoride resin by weight in color coat.

        1) Color and Gloss: To match AF-1.

b. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mils (0.013 mm).

C. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653 / A 653M, G90 (Z275) coating designation; structural quality, mill phosphatized for field painting, not less than 0.025 in (24 gage) (0.64 mm) nominal thickness, unless otherwise indicated.

D. Stainless-Steel Sheet: ASTM A 240 / A 240M or ASTM A 666, Type 304, No. 2D (dull, cold rolled) finish, not less than 0.025 in (24 gage) (0.64 mm) nominal thickness, unless otherwise indicated.

2.5 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Rubberized Asphalt Underlayment Sheet: Minimum 30 mils to 40 mils (0.76 mm to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).
3. Manufacturers and Products:

   a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
   b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
   c. Henry Company; Blueskin PE200 HT.
   d. Metal-Fab Manufacturing, LLC; MetShield.
   e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

4. Primer: Provided by underlayment manufacturer.
5. Underlayment Sealing Tape: Provided by underlayment manufacturer.

2.6 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete sheet metal flashing and trim installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
3. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel Sheet: Hot-dip galvanized steel according to ASTM A 153 / A 153M, ASTM F 2329, or Series 300 stainless steel.
4. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
5. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
6. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

C. Elastomeric Sealant for use at Exposed Joints: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Butyl Sealant for use at Concealed Joints: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

E. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, or cold-applied asphalt emulsion complying with ASTM D 1187; compounded for 15 mils (0.4 mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

G. Solder: As recommended by manufacturer as appropriate for metal roof panel materials.

1. For Zinc: ASTM B 32, 40 percent tin and 60 percent lead with low antimony, as recommended by manufacturer.
2. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.

H. Downspout Adapter: Manufactured transition boot for connecting downspouts to storm drainage below grade.

1. Adapter Body: Cast aluminum, 356 alloy, 5 inches by 5 inches, powder blast satin finish.
2. Sweep: 90 degree for horizontal discharge.
3. Outlet Boot: Schedule 40 PVC, 5-inch-diameter.
4. Basis-of-Design: McKinley Iron Works; Type DS2.

2.7 ROOF-EDGE DRAINAGE SYSTEMS

A. Provide pre-manufactured or shop-fabricated roof-edge drainage systems.

B. Pre-Manufactured Roof-Edge Drainage System Manufacturers:

1. Architectural Products Company.
2. Cheney Flashing Company.
3. Hickman Company, W. P.
4. MM Systems Corporation.

C. Gutters: Manufactured/fabricated in uniform section lengths minimum 96 in (2400 mm) long but not exceeding 12 ft (3.6 m), with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 in (25 mm) above front edge. Furnish gutter supports, gutter bead reinforcing bars, butt-type expansion joints, and accessories fabricated from same metal as gutters.

1. Fabricate from the following exposed metal:

a. Formed Aluminum: Thickness as required by manufacturer based upon gutter width and depth.

2. Gutter Profile: As indicated on drawings.
3. Corners: Factory mitered and continuously welded.
4. Gutter Supports: As indicated below of size recommended by SMACNA but not less than twice the gutter thickness with finish matching the gutters.

a. Straps.

5. Gutter Accessories:

   a. Continuous screened leaf guard with sheet metal frame.
   b. Bronze wire ball downspout strainer.

6. Color of Gutter, Supports and Fasteners: AF-1.

D. Downspouts: Plain rectangular downspouts, unless indicated otherwise, complete with smooth-curve elbows, manufactured/fabricated from the same exposed metal as gutters. Furnish with metal hangers and anchors, of same material as downspouts. Size as recommended by SMACNA.

1. Color of Downspouts, Supports and Fasteners: AF-1.

2.8 Miscellaneous Flashings

A. Fabricate to cross section indicated with clips and accessories required for secure watertight installation. Meet recommendations of SMACNA for fabrication details and metal thicknesses.

1. Not-Exposed to Public View: Zinc-coated (galvanized) steel sheet.
2. Concealed from View by other Construction: Stainless steel sheet

2.9 SHOP-FABRICATION, GENERAL

A. General: Where allowed, custom shop-fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 in in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8 in (3-mm) offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 in (25 mm) deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

H. Do not use graphite pencils to mark metal surfaces.

2.10 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water. Overlap edges not less than 3-1/2 in (87 mm). Roll laps with roller. Cover underlayment within 14 days.

3.5 FLASHING AND SHEET METAL INSTALLATION

A. General: Anchor sheet metal flashing materials and fabrications securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required for complete systems.

1. Install sheet metal flashing materials and fabrications level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install sheet metal flashing materials and fabrications to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of sheet metal flashing materials and fabrications is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection:

1. Bituminous Coating: Coat concealed side of uncoated aluminum and stainless-steel sheet metal flashing materials and fabrications with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of self-adhering, high-temperature sheet underlayment.
3. Asphalt Roofing Cement: Bed flanges in thick coat of asphalt roofing cement where required by manufacturer of sheet metal flashing materials and fabrications for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed sheet metal flashing materials and fabrications.

1. Space movement joints at a maximum of 10 ft (3 m) with no joints within 18 in (450 mm) of corners or intersections, unless otherwise shown on Drawings.
2. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 in (25 mm) deep, filled with butyl sealant concealed within joints.
3. When ambient temperature at time of installation is between 40 deg F and 70 deg F (4 deg C and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints with elastomeric or butyl sealant as required for watertight construction.

1. At concealed sealant joints, embed hooked flanges of joint members not less than 1 in (25 mm) into butyl sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 deg F and 70 deg F (4 deg C and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. At exposed sealant joints, prepare joints and apply elastomeric sealants to comply with requirements in Division 07 Section "Joint Sealants".

3.6 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Gutters: Join gutter lengths with riveted and soldered joints or with lapped joints sealed with butyl sealant. Allow for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter supports spaced not more than 30 in (750 mm) apart. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Fasten gutter spacers to front and back of gutter.
2. Loosely lock straps to front gutter bead and anchor to roof deck.
3. Anchor and loosely lock back edge of gutter to continuous cleat.
4. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 30 in (750 mm) apart.
5. Install gutter with expansion joints at locations indicated but not exceeding 50 ft (15 m) apart. Install expansion joint caps.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 in (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 in (1500 mm) on center.

1. Connect downspouts to underground drainage system indicated.

3.7 MISCELLANEOUS FLASHING INSTALLATION

A. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 in (100 mm) over base flashing. Install stainless-steel draw band and tighten.

B. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof.

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall inspect first day's Work and periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

3.9 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing materials and fabrications are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

B. Replace sheet metal flashing materials and fabrications that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 8116

CEMENTITIOUS FIREPROOFING

PART 1 - GENERAL

1.1 SUBMITTALS

A. Fire-Rated Assembly Design Classification: Submit documentation issued by testing agency for each fire-rated assembly design selected.

B. Product Data: Submit manufacturer's technical literature for each fire-resistive material specified, including primers and topcoats if any; include steel surface preparation requirements.

C. Shop Drawings: Submit plans, and details if necessary, indicating extent of structural steel member to receive fire-resistive materials.

1. Source: Submit one of following:

a. Shop drawings specifically prepared by fire-resistive materials applicator with required information.
b. Structural steel fabricator's erection plans with required information hand-marked and color-coded.

2. Required Information:

a. Show requirements for steel surface preparation.
b. Identify locations for each fire-rated assembly design selected.
c. Indicate minimum fire-resistive material thicknesses needed to achieve required fire-ratings.

D. Samples for Verification Purposes: Submit samples, not less than 4 inches square, for each fire-rated assembly design selected.

E. Manufacturer's Project Acceptance Certification: Submit certifying that fire-resistive material components, including primers and topcoats, are approved for use in specific locations, designs, details and applications indicated.

F. Applicator's Certification by Manufacturer: Submit indicating that applicator is certified, approved, licensed, or acceptable to manufacturer to apply fire-resistive materials.

G. Compatibility and Adhesion Test Reports: Submit indicating fire-resistive material components, including primers and topcoatings, have been tested for bond with steel substrates and between each other.

H. Patching Plan: Submit written plan detailing materials and methods to be used for patching of fire-resistive materials damaged during construction.

1.2 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain primary materials from one source and by a single manufacturer; auxiliary materials by same manufacturer.

B. Applicator Qualifications:

1. Experience: Company with minimum 5 years specialized experience applying fire-resistive materials similar to scope of this project and having record of successful in-service performance and completion of projects.
2. Field Supervision: Company shall maintain full-time supervisor on job site during times specified work is in progress and who has minimum 5 years experience similar to type and scope required for this project.
3. Manufacturer Acceptance: Company shall be certified, approved, licensed, or acceptable to manufacturer to apply fire-resistive materials.

C. Compatibility and Adhesion Testing: Engage a qualified testing and inspecting agency to test for compliance with requirements for specified performance and test methods.

1. Test for bond according to ASTM E 736 and requirements in UL's "Fire Resistance Directory" for fire-resistive materials.
2. Verify that manufacturer, through its own laboratory testing or field experience, has not found primers or topcoatings to be incompatible with fire-resistive materials.

D. Fire-Test-Response Characteristics: Provide fire-resistive materials with fire-test-response characteristics indicated, as determined by testing identical products according to test method by testing agency indicated below. Identify bags containing fire-resistive materials with appropriate markings of applicable testing and inspecting agency.

1. Fire-Resistance Ratings: Tested according to UL 263/ASTM E 119/NFPA 25 under Category CHPX published in UL's "Fire Resistance Directory" for Cementitious Fireproofing.
2. Surface-Burning Characteristics: When tested according to ASTM E 84:

a. Flame Spread: Less than 25.
b. Smoke Developed: Less than 450.

E. Pre-Installation Conference: Before beginning application, conduct conference at Project site to comply with requirements of Division 01 Sections.

1. Required Attendees:

a. Owner.
b. Architect.
c. Contractor, including superintendent.
d. Applicator, including project manager and supervisor.
e. Mechanical, electrical, plumbing and fire protection subcontractors, including superintendent.

2. Minimum Agenda: Applicator shall demonstrate understanding of fire-resistive materials work required by describing in detail procedures for, but not limited to, following topics:

a. Exposure conditions, ratings, and other performance conditions.
b. Sequencing and coordination requirements.
c. Weather predictions and ambient conditions.
d. Handling, storing and protecting fire-resistive material products.
e. Evaluation of substrates on which work will be applied.
f. Application procedures.

g. Temporary enclosures and protection of property.
h. Field quality control testing procedures.
i. Tour project and discuss conditions of substrates and other preparatory work performed by other installers for compliance with Contract Documents.

1.3 PROJECT CONDITIONS

A. Environmental Requirements: Comply with manufacturer's recommendations for temperature and ventilation requirements before, during and after application.

B. Work Sequence Requirements:

1. Metal Floor Deck: Apply fire-resistive materials after concrete topping has been completed.
2. Metal Roof Deck: Apply fire-resistive materials after concrete topping and roofing installation has been completed.
3. Personnel Traffic: Prohibit on floor and roof above during application and drying of fire-resistive materials.
4. Accessories: Apply fire-resistive materials after steel stud framing, clips, hangers, supports, sleeves, and other items are in place.
5. Suspended Components: Defer installing ducts, piping, and other items that would interfere with applying fire-resistive materials until after application.

C. Protection During Work: Provide temporary enclosure as required for following:

1. Confine spraying operations and protect environment.
2. Prevent deterioration of fire-resistive materials due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
3. Prevent unnecessary abrasion and other damage likely to occur during construction operations subsequent to application.

1.4 WARRANTY

A. Manufacturers Extended Special Warranty: Furnish manufacturers standard form, signed by applicator, in which manufacturer warrants that materials and applications comply with approved fire-rated assembly design, and agrees to repair or replace fire-resistive materials that fail in material and application within 2 years from date of Material completion.

B. Coverage: Includes, but not limited to, following:

1. Defects or deterioration.
2. Cracking, flaking, or spalling.
3. Peeling or delaminating from substrates.
4. Failure to remain bonded.
5. Erosion in excess of specified requirements.
6. Faulty application.

C. Exclusions: Not covered are failures due, but not limited to, following:

1. Damage by occupants and Owner's maintenance personnel.
2. Exposure to environmental conditions other than those investigated and approved during fire-response testing.
3. Other causes not reasonably foreseeable under conditions of normal use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Provide product by one of manufacturers listed.

B. Product Standards (Basis of Design): Contract Documents are based on products indicated by fire-rated assembly design designations indicated on Drawings to establish a standard of quality.

2.2 PRIMARY MATERIALS

A. Fire-Rated Assembly Design: Selected from Product Category BXUV published in UL's "Fire Resistance Directory" for intumescent fire-resistive coating, or design of other testing agency acceptable to authorities having jurisdiction.

B. Material Compatibility: Primer, cementitious, and topcoat products shall be compatible with one another and with substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and laboratory analysis.

C. Wet-Mix Sprayed Fire-Resistive Material: Manufacturer's standard factory-mixed formulated products complying with requirements of fire-rated assembly design selected for material composition and physical properties.

1. Cementitious Material Composition: Factory-mixed, dry formulation of gypsum or portland cement cementitious binders and lightweight mineral or synthetic aggregates when mixed with water forms a slurry or mortar for conveyance and application.
2. Absence of Asbestos: Containing no detectable asbestos as determined according to method specified in 40 CFR 763, Subpart E, Appendix E, Section 1.
3. Products Not Allowed: Dry-mix Cementitious Fireproofing containing mineral fibers.

D. Minimum Physical Properties: Following values unless higher value required by fire-rated assembly design selected.

1. Minimum Dry Density: Average and individual densities, unless density indicated in fire-rated assembly design selected is greater according to ASTM E 605:

    a. Low-Density: 15 pounds per cubic foot.
    b. Medium-Density: 22 pounds per cubic foot.

2. Thickness: Minimum average thickness as required by fire-rated assembly design selected according to ASTM E 605.
3. Minimum Bond Strength: As follows according to ASTM E 736:

    a. Low-Density: 150 foot pounds per square foot.
    b. Medium-Density: 434 foot pounds per square foot.

4. Minimum Compressive Strength: As follows according to ASTM E 761:

    a. Low-Density: 7.2 foot pounds per square inch.
    b. Medium-Density: 51 foot pounds per square inch.

5. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
6. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
7. Effect of Impact on Bonding: No cracking, spalling, delamination, per ASTM E 760.

8. Air Erosion: Maximum weight loss of 0.025 grams per square foot in 24 hours according to ASTM E 859.
9. Combustion Characteristics for High-Density: Passes ASTM E 136 or ASTM E 1354.
10. Fungal Resistance: No observed growth on specimens according to ASTM G 21.
11. Acceptable Manufacturers and Products:

    a. Low-Density – Gypsum Binder:

        1) Carboline Co., Fireproofing Products Div.; Pyrolite 15 or Pyrolite 15 High-Yield.
        2) Grace Construction Products; Monokote MK-6, Monokote MK-6/HY or Monokote MK-6s.
        3) Isolatek International Corp.; Cafco 300.
        4) Southwest Vermiculite Co., Inc.; Type 5GP.

    b. Medium-Density – Gypsum Binder:

        1) Carboline Co., Fireproofing Products Div.; Pyrolite 22.
        2) Grace Construction Products; Monokote Z106G.
        3) Southwest Vermiculite Co., Inc.; Type 5MD.

    c. Medium-Density – Portland Cement Binder:

        1) Carboline Co., Fireproofing Products Div.; Pyrolcrete 239.
        2) Grace Construction Products; Monokote Z106 or Monokote Z106/HY.
        3) Isolatek International Corp.; Cafco 400.
        4) Southwest Vermiculite Co., Inc.; Type 7GP.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials compatible with fire-resistive materials and substrates approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-rated assembly design selected.

B. Bonding Adhesive: If required, product provided by fire-resistive materials manufacturer for enhancing bond between substrate and fire-resistive materials.

C. Patching Material: Product provided by fire-resistive materials manufacturer for patching damaged work.

D. Substrate Conditioner Coating: If required, product provided by fire-resistive materials manufacturer for coating substrate prior to application complying with one of following:

    1. Bond strength complies with requirements specified in UL's "Fire Resistance Directory" for coating materials based on series of bond tests according to ASTM E 736.
    2. Identical to those used in approved fire-rated assembly design.

E. Reinforcements: One of following materials fabricated of weight, configuration, and finish required to comply with fire-rated assembly design selected and manufacturer's written recommendations; include clips, accessories, and other anchorage devices required to attach reinforcement to substrates scheduled to receive fire-resistive materials:

    1. Expanded metal lath.
    2. Steel pins.
    3. Glass fiber or polypropylene fabric mesh.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Conditions: Examine substrate surfaces to which Cementitious Fireproofing will be applied for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance.

3.2 PREPARATION

A. Protection of Adjacent Work: Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.

B. Substrate Conditions: Coordinate substrate preparations with Division 05 Section "Structural Steel".

1. Clean substrates of substances that have potential of impairing bond of fire-resistive materials, including dirt, oil, grease, release agents, rolling compounds, loose mill scale, incompatible primers, paints, identification markings, and encapsulants as recommended by fire-resistive material manufacturer.
2. Objects penetrating fire-resistive materials, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
3. Substrates are not obstructed by ducts, piping, equipment, walls, and other suspended construction that will interfere with application of fire-resistive materials.
4. If steel has been coated with paint or primer, manufacturer shall determine if paint or primer has to be removed, or if fire-resistive materials can be applied without removal. If additional materials are required, include at no additional cost to Owner.

3.3 INSTALLATION

A. Installation Quality Standard: In addition to standards listed elsewhere, apply Cementitious Fireproofing work according to following, unless otherwise specified:

1. Respective manufacturer's written application instructions.
2. Approved submittals.
3. Contract Documents.

B. Application Procedures: Apply fire-resistive materials in thicknesses and densities required to achieve each fire-rated assembly design selected.

1. Comply with manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey and spray fire-resistive materials, as applicable to particular conditions of installation and as required to achieve fire-rated assembly design selected.
2. Where required, coat substrates with bonding adhesive or substrate primers before applying fire-resistive materials.
3. Spray fire-resistive materials to maximum extent possible, then complete coverage by trowel application or other placement method recommended in writing by manufacturer.
4. Maintain profile of substrates. Fill voids between members, including voids formed by corrugated and fluted decks above beams and similar voids.
5. Cure fire-resistive materials according to fire-resistive materials manufacturer requirements.

C. Patching: Under following conditions, remove Cementitious Fireproofing and re-apply same Cementitious Fireproofing as used for original application, or apply patching material:

1. Portions damaged, abraded, or removed by subsequent building construction.
2. Previously applied materials determined by testing and inspection agency to be noncompliant.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide assistance at beginning of application and perform periodic inspections by qualified technical representative to verify that systems installation is in conformance with manufacturer's requirements and approved fire-rated assembly design.

B. Testing and Inspection Services: Design Professional will engage a qualified independent testing and inspection agency to perform field tests and inspections and to prepare test reports.

1. Agency Responsibilities:

a. Agency personnel performing tests and inspections shall have not less than 3 years experience in conducting field testing procedures.
b. Perform following tests and inspections according to local building code; if no building code requirements perform tests according to AWCI Technical Manual 12-A:
c. Required Testing and Inspections:

1) Substrate Condition: Inspect to determine if substrates are prepared properly and comply with specified requirements; determine if substrate temperature at time of application is acceptable.
2) Site Conditions During Application: Determine if temperature, humidity and other weather conditions comply with specified requirements.
3) Thickness for Floor, Roof, and Wall Assemblies: Measure not less than 4 random symmetrical locations within a 12-inch-square test area for each 1,000 square foot area, or partial area, on each floor according to ASTM E 605. For fluted deck, take measurements at the valley, crest and sides.
4) Thickness for Structural Frame Members: Measure 25 percent of following structural members on each floor, at each end of 12 inch long test area, according to ASTM E 605:

a) Beams: 9 measurements (total 18 measurements).
b) Columns: 12 measurements (total 24 measurements).
c) Joists (Trusses): 7 measurements (total 14 measurements).

5) Density for Floors, Roofs, Walls, and Structural Frame Members: Test density of following for each 10,000 square foot area, or partial area, on each floor according to ASTM E 605:

a) Beam: Bottom of lower flange or web.
b) Column: Outside of flange or web.
c) Floor and Roof Decking: Flat portion.

6) Bond Strength for Floors, Roofs, Walls, and Structural Framing Members: Test cohesive/adhesive bond strength for not less than 1 sample of following for each 10,000 square foot area, or partial area, on each floor according to ASTM E 736:

a) Beams.
b) Columns.
c) Joist (Trusses).
d) Floor, roof and wall assemblies.

7) Patching: Inspect to determine if damaged substrates are properly patched to comply with approved fire-rated assembly design and approved patching plan submittal.

d. Reports shall contain not less than the information required by AWCI Technical Manual 12-A.
e. Interpret tests and inspections and state in each report whether applications comply with or deviate from specified requirements including, but not limited to, manufacturers product data and approved fire-rated assembly design.
f. If applications are found not in compliance with specified requirements perform additional random testing to determine extent of noncompliance at Contractor's expense.
g. Perform testing and inspecting to determine compliance of replaced, or additional work necessary because of noncompliant areas, with specified requirements at Contractor's expense.

2. Contractor's Responsibilities:

a. Proceed with application for next area only when test and inspection results for previously completed applications show compliance with specified requirements. Tested values must equal or exceed values required for each approved fire-rated assembly design.
b. Remove and replace applications where test and inspection results indicate it does not comply with specified requirements.
c. Apply additional fire-resistive materials where test and inspection results indicate application does not comply with specified requirements.
d. Additional testing and inspecting will be performed to determine compliance of replaced or additional work with specified requirements at Contractor's expense.

3.5 PROTECTION

A. Protection: Protect fire-resistive materials from abrasion and damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of Material completion.

3.6 REPAIR

A. Coordination: Coordinate application of fire-resistive materials with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect fire-resistive materials and patch any damaged or removed areas. Repair or replace work that has not been successfully protected.

3.7 SCHEDULE OF TYPICAL LOCATIONS AND TYPES

	Low-Density Gypsum based	Medium-Density Gypsum Based	Medium-Density Portland Cement Based	High-Density Portland Cement Based
Interior Structural Steel – Mechanical, Electrical & Equipment Rooms			X	
Interior Structural Steel – Elevator Shafts			X	
Interior Structural Columns – Concealed by Walls	X			
Interior Structural Beams – Concealed by Ceilings	X			
Interior Structural Columns – Exposed to View			X	
Interior Structural Beams – Exposed to View		X	X	

END OF SECTION

SECTION 07 8413

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes penetration firestopping systems for openings and penetrations through smoke and fire-resistance-rated assemblies, and supplementary items necessary to complete their installation.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide firestopping systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.

B. F-Rated Systems: Provide penetration firestopping systems with F-ratings determined per ASTM E 814, equaling or exceeding fire-resistance rating of constructions penetrated.

C. T-Rated Systems: For the following conditions, provide penetration firestopping systems with T-ratings, as well as F-ratings, determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

1. Penetrations located outside wall cavities.
2. Penetrations located outside fire-resistive shaft enclosures.
3. Penetrations located in construction containing fire-protection-rated openings.
4. Penetrating items larger than 4-inch-diameter nominal pipe or 16 sq. in. in overall cross-sectional area.

D. For penetration firestopping systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

1.3 SUBMITTALS

A. Product Data: For each type of firestopping system product indicated.

B. Shop Drawings: For each firestopping system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestopping design designation of testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each firestopping system configuration for construction and penetrating items.
2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular firestopping condition, submit illustration, with modifications marked, approved by firestopping system manufacturer's fire-protection engineer.

C. Product Certificates: Signed by manufacturers of firestopping system products certifying that products furnished comply with requirements.

D. Product Test Reports: From a qualified testing agency indicating firestopping system complies with requirements, based on comprehensive testing of current products.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed firestopping systems similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations: Obtain penetration firestopping systems, for each kind of penetration and construction condition required, from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide firestopping systems that comply with the following requirements and those specified in "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency performing testing and follow-up inspection services for firestopping systems.
2. Penetration firestopping systems: Provide materials that are identical to those tested per ASTM E 814. Provide rated firestopping system products that bear classification marking of qualified testing and inspecting agency.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination".

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install firestopping systems when ambient or substrate temperatures are outside limits permitted by firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate firestopping systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that firestopping systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate firestopping systems.

C. Do not cover up firestopping system installations that will become concealed behind other construction until inspecting agency have examined each installation.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

A. Acceptable Manufacturers: Manufacturer is “acceptable” if firestopping system has been tested and listed by UL and manufacturer can evidence product compliance with requirements of the Contract Documents.

B. Compatibility: Provide firestopping systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating firestopping systems, under conditions of service and application, as demonstrated by firestopping system manufacturer based on testing and field experience.

C. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by firestopping system manufacturer and approved by the qualified testing and inspecting agency for firestopping systems indicated.

2.2 PENETRATION FIRESTOP SYSTEMS

A. Description: Classified in Underwriters Laboratories (UL) Fire Resistance Directory, "Section XHEZ - Penetration Firestop Systems", and/or "Section XHHW - Fill Void or Cavity Materials" for specific project conditions.

B. Application Considerations:

1. Firestops exposed to view and/or are scheduled to receive finishes shall be paintable or capable of receiving finish materials.
2. Firestops exposed to traffic, moisture, and physical damage shall be products that do not deteriorate when exposed to these conditions.
3. Firestops for water piping penetrations, of any type, shall be moisture-resistant products.
4. Firestops for floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic shall be products capable of supporting the floor loads involved either by installing floor plates or by other means.
5. Firestops for penetrations involving insulated piping shall be products that do not require removal of insulation.
6. Firestops for cable trays and future penetrations shall be reusable pillows or bags.

C. Provide firestops within fire resistive walls and partitions containing flush mounted devices such as outlet boxes, electrical cabinets and mechanical cabinets mounted back to back and spaced less than 24 inches on center in accordance with UL Fire Resistance Directory "Wall Opening Protective Materials", Category CLIV.

D. For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive firestopping systems and associated work and conditions under which work will be installed. Do not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the Installer. Starting of work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:

1. Remove foreign materials from surfaces of openings, joints and penetrating items that could interfere with adhesion of firestopping.
2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form release agents from concrete.

B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.3 INSTALLATION OF PENETRATION FIRESTOPS

A. General: Comply with the "System Performance Requirements" Article and the penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for penetration firestop systems by proven techniques to produce the following results:

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Inspection:

1. Design Professional will employ an independent Inspecting agency to examine firestopping system installations through the course of construction to determine, in general, if it is being installed in compliance with specified requirements. Inspections shall include the following verifications:

a. Verify that proper specified firestopping system products and materials are used.
b. Verify installer's credentials and certification.

c. Verify that each firestopping system is installed in accordance with product manufacturer's latest published requirements.
d. Verify that firestopping system materials and installation comply with appropriate rating authorities' requirements.
e. Verify that firestopping system is installed in specified and/or indicated locations in rated assemblies.

2. Do not proceed to enclose firestopping system installations with other construction until reports of examinations are issued.
3. Where deficiencies are found, repair or replace firestopping system materials and products to bring deficient installation into compliance with specified requirements.

3.5 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping system products and of products in which opening and joints occur.

B. Protect firestopping system components during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Material Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 07 8446

FIRE RESISTIVE JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes firestopping systems for joints at perimeter and through smoke and fire-resistance-rated assemblies, and supplementary items necessary to complete their installation.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide firestopping systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which firestopping systems are installed.

B. Fire-Resistant Joint Sealants: Provide systems for sealing linear joints in fire resistive rated assemblies that have ratings with movement capabilities equaling or exceeding the fire resistance rating of construction which joint occurs, as determined by UL 2079 or ASTM E 1966.

C. Perimeter Fire Containment System: Provide systems for establishment of a fire resistive barrier at the portion of perimeter exterior wall (spandrel) that is adjacent to edge of structural floor or roof slabs, that provides and maintains a resistance to the passage of fire from one floor to the floor above. Provide fire resistive rating with movement capabilities equaling or exceeding the rating of the adjacent floor or roof assembly, as determined by UL 2079 or ASTM E 1966.

1. Integrity Rating: Measure of system's ability to withstand fire exposure without permitting passage of flame through openings or occurrence of flaming on any element of the unexposed surface of the fill material or floor or on the interior surface of the wall above the fill material.
2. Insulation Rating: Measure of system's resistance to both flame passage and heat transfer and requires maximum temperature rise on unexposed side of the fill material or on interior surface of the wall 1 inch above fill material not to exceed 325 deg F above starting temperature. For system's having a clearance distance of 6 inches or greater between wall and structural slab, average temperature rise shall not exceed 250 deg F above starting temperature.

D. Expansion and Contraction: Perimeter fire containment systems shall accommodate movement of the exterior wall due to thermal expansion and contraction.

E. For firestopping systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

1.3 SUBMITTALS

A. Product Data: For each type of firestopping system product indicated.

B. Shop Drawings: For each firestopping system, show each kind of construction condition and relationships to adjoining construction. Include firestopping design designation of testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each firestopping system configuration for each type construction.
2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular firestopping condition, submit illustration, with modifications marked, approved by firestopping system manufacturer's fire-protection engineer.

C. Product Certificates: Signed by manufacturers of firestopping system products certifying that products furnished comply with requirements.

D. Product Test Reports: From a qualified testing agency indicating firestopping system complies with requirements, based on comprehensive testing of current products.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed firestopping systems similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations: Obtain firestopping systems, for each kind of construction condition required, from a single manufacturer.

C. Compatibility and Adhesion Testing: Manufacturer of fire stopping material shall be responsible for testing samples of materials that will contact or affect firestopping materials.

1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of fill materials to joint substrates.
2. Perform tests under environmental conditions replicating those that will exist during installation.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain fire-resistant joint sealants manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

D. Fire-Test-Response Characteristics: Provide firestopping systems that comply with the following requirements and those specified in "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency performing testing and follow-up inspection services for firestopping systems.
2. Fire Resistive Joint System: Provide materials that are identical to those tested according to UL 2079 or ASTM E 1966. Products shall have a flame spread rating of less than 25.

a. Where UL-classified fire-resistant joint sealants are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHBN.

3. Perimeter Fire Containment System:

   a. Curtainwall Insulation and Mullion Cover Material: Provide materials that are identical to those tested according to ASTM E 136. Products shall have the following ratings:

      1) Flame Spread: Less than 25.
      2) Smoke Developed: 0.

   b. Safing Material: Provide materials that are identical to those tested according to ASTM E 84. Products shall have the following ratings:

      1) Flame Spread: Less than 15.
      2) Smoke Developed: 0.

   c. System: Provide materials that are identical to those tested according to a modified ASTM E 119 test, where the furnace is modified to simulate a floor as it intersects with the wall. System shall have the following ratings:

      1) Integrity Rating: 2 hours.
      2) Insulation Rating: 3/4 hours.

   d. Where UL-classified perimeter fire-containment systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHBN or XHDG.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install firestopping systems when ambient or substrate temperatures are outside limits permitted by firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate firestopping systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

A. Coordinate construction of openings to ensure that firestopping systems are installed according to specified requirements.

B. Do not cover up firestopping system installations that will become concealed behind other construction until inspecting agency has examined each installation.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

A. Acceptable Manufacturers: Manufacturer is "acceptable" if firestopping system has been tested and listed by UL and manufacturer can evidence product compliance with requirements of the Contract Documents.

B. Compatibility: Provide firestopping systems that are compatible with one another and the substrates forming openings, under conditions of service and application, as demonstrated by firestopping system manufacturer based on testing and field experience.

C. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by firestopping system manufacturer and approved by the qualified testing and inspecting agency for firestopping systems indicated.

2.2 TOP-OF-WALL JOINT FIRESTOPPING

A. Safing Insulation: Semi rigid board insulation produced by combining slag-wool fibers with thermosetting resin binders and complying with the following:

1. ASTM C 612, Type 1A and 1B.
2. Nominal density of 4 lb/cu. ft.
3. ASTM E 119 Fire rating indicated, but not less than 2 hours.

B. Coating Material: Manufacturers standard fill material or spray applied product for sealing surface of safing insulation and adjacent construction against penetration of fire and smoke.

C. Fire Resistive Sealants: Intumescent single-component, water based, high solids, elastomeric sealants. Nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant.

2.3 EDGE-OF-SLAB JOINT FIRESTOPPING

A. Safing Insulation: Semi rigid board insulation produced by combining slag-wool fibers with thermosetting resin binders and complying with the following:

1. ASTM C 612, Type 1A and 1B.
2. Nominal density of 4 lb/cu. ft.
3. ASTM E 119 Fire rating indicated, but not less than 2 hours.

B. Coating Material: Manufacturers standard fill material or spray applied product for sealing surface of safing insulation and adjacent construction against penetration of fire and smoke.

2.4 PERIMETER FIRE CONTAINMENT SYSTEM

A. Curtainwall Insulation and Mullion Cover: Semi-rigid board insulation produced by combining slag-wool or rock-wool fibers with thermosetting resin binders, aluminum foil scrim backing, and complying with the following:

1. ASTM C 612, Type 3.
2. Nominal density of 8 and 4 lb/cu. ft. as required by test assembly.
3. ASTM E 119 fire rating as indicated, but not less than 2 hours.

B. Safing Material: Semi-rigid board insulation produced by combining slag-wool fibers with thermosetting resin binders, unfaced, and complying with to the following:

1. ASTM C 612, Type IA and IB.
2. Nominal density of 4 lb/cu. ft.
3. ASTM E 119 fire rating as indicated, but not less than 2 hours.

C. Coating Material: Manufacturer's standard fill material or spray applied product for sealing top of safing material.

D. Impaling Pins: 12 gage steel pins swaged to galvanized steel angles for screw attachment to glazed aluminum wall system aluminum framing.

E. Reinforcing Angles: Galvanized steel angles of size, thickness, and finish suitable for application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive firestopping systems and associated work and conditions under which work will be installed. Do not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the Installer. Starting of work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:

1. Remove foreign materials from surfaces of joints that could interfere with adhesion of firestopping.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form release agents from concrete.

B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.3 INSTALLATION - GENERAL

A. Install fire-stopping systems to comply with "Performance Requirements" Article and fire-stopping system manufacturer's written installation instructions for products and applications indicated.

B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Install fill materials for fire-resistant joint sealants by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.

2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 INSTALLATION OF FIRE-RESISTANT JOINT SEALANTS

A. Comply with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.

C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.

D. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.5 INSTALLATION OF FIRE SAFING PROTECTION

A. Top of Wall: Install safing insulation to fill gap between top of wall and floor slab above. Cut safing insulation 50 percent wider than gap to be filled to ensure compression fit.

B. Edge of Slab: Install safing insulation to fill gap between edge of structural floor/roof slab and back of exterior wall on safing clips spaced as needed to support insulation but not further apart then 24 inches o.c. unless not required by tested system. Cut safing insulation 50 percent wider than gap to be filled to ensure compression fit or install vertically as required by tested assembly.

C. Install coating material or smoke seal compound to cover fill material and seal opening.

3.6 INSTALLATION OF FIRE CONTAINMENT SYSTEM

A. Install system to extend the required vertical distance above and below the structural floor/roof slab but not less than to next horizontal mullion.

B. Attach impaling pins to glazed aluminum wall framing, using screws, at corners and around perimeter of glazed unit. Install curtainwall insulation material over impaling pins so that the edges are tight fitting against the aluminum frame and the face of material will be flush with the aluminum frame. Secure units with clinch shields over impaling pins. Locate horizontal seams in the curtainwall insulation material, 6 inches from top of joint and provide supporting angles as required.

C. Install safing material in the joint between the interior face of aluminum frame (and face of curtainwall insulation material) and the edge of the structural floor or roof slab. Compression fit safing material 50 percent, or as required by tested assembly, into spaces between floor slab and mounting angles. Provide safing clips to support safing material if required by tested system. Install coating material or smoke seal over safing material flush with top of floor/roof slab.

D. Install mullion covers centered over horizontal and vertical aluminum frames within barrier area using the same impaling pins as used to attach the curtainwall insulation material. Secure covers with clinch shields over impaling pins.

3.7 FIELD QUALITY CONTROL

A. Inspection:

1. Design Professional will employ an independent Inspecting agency to examine firestopping system installations through the course of construction to determine, in general, if it is being installed in compliance with specified requirements. Inspections shall include the following verifications:

   a. Verify that proper specified firestopping system products and materials are used.
   b. Verify installer's credentials and certification.
   c. Verify that each firestopping system is installed in accordance with product manufacturer's latest published requirements.
   d. Verify that firestopping system materials and installation comply with appropriate rating authorities' requirements.
   e. Verify that firestopping system is installed in specified and/or indicated locations in rated assemblies.

2. Do not proceed to enclose firestopping system installations with other construction until reports of examinations are issued.
3. Where deficiencies are found, repair or replace firestopping system materials and products to bring deficient installation into compliance with specified requirements.

3.8 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping system products and of products in which joints occur.

B. Protect firestopping system components during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Material Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION

SECTION 07 9200

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Joint sealants, backing materials, and supplementary items necessary for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing full range of colors available for each product exposed to view.

C. Samples for Verification Purposes: Samples for each kind and color of joint sealants in 1/2 in (12 mm) wide joints formed between two 6 in (150 mm) long strips of material matching appearance of exposed surfaces adjacent to joint sealants.

D. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

E. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control" Article.

F. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

G. Qualification Data: For installer.

1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.

H. Warranties: Sample of warranties.

1. Provide manufacturer's and installer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer with not less than 10 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 10 years, and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project site during times specified Work is in progress that is experienced in installing systems similar to type and scope required.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

B. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with minimum of 5 years experience in providing recommendations, observations, evaluations, and problem diagnostics. Sales representatives are not acceptable.

C. Mock-Ups: Before beginning Work of this Section, install joint sealants in mock-ups of the various assemblies specified in other Sections indicated to receive joint sealants specified in this Section. Mock-ups shall include each form of product and color required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

D. Pre-Construction Compatibility and Adhesion Testing: Provide samples of joint substrate materials that will contact or affect urethane and silicone joint sealants to respective joint sealant manufacturers for following testing:

1. General Requirements: Test materials forming joint substrates and joint sealant backings for compatibility and adhesion with joint sealants.
2. Test Method: Manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
3. Specimen Quantity: Provide not fewer than number of pieces required of each kind of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
4. Reports: Interpret test results and certify reports indicating requirements for primers and substrate preparation needed for adhesion or for corrective measures including use of specially formulated primers.

E. Pre-Construction Stain Testing: Submit samples of joint substrate materials that will contact or affect urethane and silicone joint sealants to respective joint sealant manufacturers for following testing:

1. General Requirements: Test materials forming joint substrates for resistance to staining caused by joint sealants.
2. Test Method: ASTM C 1248.
3. Specimen Quantity: Provide not fewer than number of pieces required by testing laboratory of each kind of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
4. Reports: Interpret test results and certify reports indicating if joint sealants stain substrate materials.

1.4 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

a. Owner.
b. Architect.
c. Contractor, including superintendent.
d. Installer, including project manager and supervisor.
e. Manufacturer's qualified technical representative.
f. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Work requirements (Drawings, Specifications, and other Contract Documents).
c. Review required submittals, both completed and yet to be completed.
d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
e. Review required inspection, testing, certifying, and material usage accounting procedures.
f. Review environmental conditions and procedures for coping with unfavorable conditions.
g. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.5 PROJECT CONDITIONS

A. Ambient Conditions: Install joint sealants within range of ambient and substrate temperatures and moisture conditions as recommended by manufacturer. Protect substrates from environmental conditions that affect performance. Do not apply to a damp or wet substrate or during high humidity conditions including snow, rain, fog, or mist.

B. Weather Conditions Limitation: Proceed with Work only when existing and forecasted weather conditions will permit installation according to manufacturer's instructions and warranty requirements.

1.6 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.7 WARRANTY

A. Manufacturer's Warranty for Urethane Sealants: Furnish manufacturer's written material warranty for a period of 5 years from date of Material Completion signed by an authorized representative using manufacturer's standard form agreeing to furnish materials required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

B. Manufacturer's Warranty for Silicone Sealants: Furnish manufacturer's written material for a period of 20 years from date of Material Completion signed by an authorized representative using manufacturer's standard form agreeing to furnish materials required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

C. Installer's Warranty: Furnish installer's written warranty for a period of 2 years from date of Material Completion signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Provide product by one of manufacturers listed.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Compatibility: Joint sealants, backings, and other related materials shall be compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint sealant manufacturer based on testing and field experience.

C. Volatile Organic Compounds (VOC) Content of Interior Sealants: Sealants and primers for use inside weatherproofing system shall comply with following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):

1. Elastomeric Sealants: 250 g/L.
2. Primers for Non-Porous Substrates: 250 g/L.
3. Primers for Porous Substrates: 775 g/L.

D. Suitability for Contact with Food: Comply with authorities having jurisdiction for joints in repeated contact with food.

2.3 EXTERIOR ELASTOMERIC SEALANTS

A. Exterior Pourable Urethane Sealant:

1. Product Quality Standard: ASTM C 920, Type M, Grade P, Class 25, Use T.
2. Description: Multi-component, pourable, moisture curing, polyurethane sealant; rated for incline when used on sloped surfaces.
3. Joint Movement Capability: Plus 25 percent, minus 25 percent.
4. Primers: Product provided by sealant manufacturer if required by conditions.
5. Manufacturers and Products:

    a. BASF; Sonolastic SL 2.
    b. May National Associates, Inc.; Bondaflex PUR 35SL.
    c. Pecora Corp.; Urexpan NR-200.
    d. Sika Corp., Construction Products Div.; Sikaflex 1CSL.
    e. Tremco Commercial Sealants & Waterproofing; THC-900/THC-901.

6. Color: As selected by Architect from manufacturer's standard and custom colors.

B. Exterior Non-sag Silicone Sealant:

1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 50 or 100/50 as applicable for substrate.
2. Description: Single component, non-sag, neutral cure, non-staining as determined by pre-construction stain testing, and non-bleeding, silicone sealant.
3. Joint Movement Capability:

    a. Class 50: Plus 50 percent, minus 50 percent.
    b. Class 100/50: Plus 100 percent, minus 50 percent.

4. Primers: Product provided by sealant manufacturer if required by conditions.
5. Manufacturers and Products:

    a. Class 50:

        1) Bondaflex Technologies; Sil 295.
        2) Dow Corning; 795 Silicone Building Sealant.
        3) Momentive Performance Materials, Inc. (GE Silicones); SilPruf SCS2000.
        4) Pecora Corp.; 864 NST.
        5) Tremco Commercial Sealants & Waterproofing; Spectrem 3.

    b. Class 100/50:

        1) Bondaflex Technologies; Sil 290.
        2) Dow Corning; 790 Silicone Building Sealant.
        3) Momentive Performance Materials, Inc. (GE Silicones); Silpruf LM SCS2700.
        4) Pecora Corp.; 890 NST.
        5) Tremco Commercial Sealants & Waterproofing; Spectrem 1.

6. Color: As selected by Architect from manufacturer's standard and custom colors.

2.4 INTERIOR ELASTOMERIC SEALANTS

A. Interior Non-sag Silicone Sealant:

1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 25.
2. Description: Single component, non-sag, moisture curing, silicone sealant specially formulated with fungicide for use in sanitary non-porous applications.
3. Manufacturers and Products:

    a. BASF; Omniplus.
    b. Dow Corning; 786 Silicone Sealant.
    c. Momentive Performance Materials, GE Silicones; Sanitary SCS1700.
    d. Pecora Corp.; 898.
    e. Tremco Commercial Sealants & Waterproofing; Tremsil 200.

4. Color: As selected by Architect from manufacturer's standard and custom colors.

B. Interior Non-sag Urethane Sealant:

1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 25 or 35.
2. Description: Single component, non-sag, moisture curing, non-staining as determined by pre-construction stain testing if exposed, polyurethane sealant.
3. Joint Movement Capability: Plus 25 percent, minus 25 percent, or plus 35 percent, minus 35 percent.
4. Primers: Product provided by sealant manufacturer if required by conditions.
5. Manufacturers and Products:

    a. BASF; Sonolastic NP 1.
    b. Pecora Corp.; Dynatrol I-XL.
    c. Tremco Commercial Sealants & Waterproofing; Dymonic or Vulkem 116.

6. Color: As selected by Architect from manufacturer's standard and custom colors.

C. Interior Non-sag Acrylic Latex Sealant:

1. Product Quality Standard: ASTM C 834, Type and Grade as required by conditions.
2. Description: Single component, non-sag, moisture curing, general purpose, paintable, siliconized acrylic latex sealant.
3. Joint Movement Capability: Plus 7.5 percent, minus 7.5 percent
4. Manufacturers and Products:

    a. BASF; Sonolac.
    b. Pecora Corp.; AC 20+.
    c. Tremco Commercial Sealants & Waterproofing; Tremflex 834.

5. Color: As selected by Architect from manufacturer's standard and custom colors.

D. Sprayed Foam Insulating Gap Filler:

1. Description: Low pressure, one-component, expanding, closed-cell polyurethane insulating foam gap filler; applied with professional hand-held dispensing gun; CFC and HCFC free.
2. Performance Requirements: Class 1 Fire-Retardant per ASTM E 84.

3. Manufacturers and Products:

    a. Convenience Products; Touch 'n Seal.
    b. Dow Chemical Co.; Great Stuff Pro.
    c. Fomo Products, Inc.; Handi-Foam.
    d. RHH Foam Systems, Inc.; Versi-Tite

E. Acoustical Sealants: As specified in Division 09 Section "Gypsum Board Assemblies".

F. Fire Resistive Sealants: As specified in Division 07 Section "Fire Resistive Joint Systems".

2.5 JOINT SEALANT BACKING

A. Foam Backer Rods:

1. Product Quality Standard: ASTM C 1330, Type C, Type O, Type B.
2. Description: Extruded polyethylene, polyurethane, or polyolefin in either closed cell structure (Type C), open cell structure (Type O), or bicellular structure with surface skin (Type B) as defined by ASTM C 717.
3. Size: Diameter approximately 25 percent larger than joint width, unless otherwise directed by manufacturer.
4. Manufacturers and Products:

    a. Type C:

        1) BASF; Sonneborn, Closed-Cell Backer Rod.
        2) Nomaco Inc.; Green Rod or HBR.

    b. Type O:

        1) Backer Rod Mfg. Inc.; Denver Foam.
        2) Nomaco Inc.; Foam-Pak II.

    c. Type B:

        1) BASF; Sonneborn, Soft Backer Rod.
        2) Nomaco Inc.; Dual-Rod or Sof-Rod.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials, or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 ACCESSORIES

A. Cleaners for Non-porous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent non-porous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

B. Masking Tape: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrate surfaces to receive products and systems and associated Work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Cleaning of Joints: Clean out joints immediately before installing joint backings and sealants to comply with joint sealant manufacturer's written instructions and following requirements:

1. Remove foreign material that could interfere with adhesion of joint sealant, including, but not limited to, dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form-release agents from concrete.
4. Clean non-porous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
5. Substrate material allowed by sealant's ASTM C 920 Use Classification.

C. Joint Priming: Prime joint substrates where recommended by joint sealant manufacturer, or as indicated by prior experience, or as required by pre-construction compatibility and adhesion testing. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

D. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.4 INSTALLATION

A. Joint Sealant Backings: Install type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear backings.
3. Remove absorbent sealant backings that have become wet or damaged before sealant application and replace with dry materials.
4. Install bond-breaker tape behind sealants where backings are not used between sealants and backs of joints.

B. Joint Sealants: Install at same time as backings using proven techniques that comply with following:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
4. Use open cell backer rod at interior line of sealant for double sealed condition.
5. Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

    a. Remove excess sealant from surfaces adjacent to joints.
    b. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
    c. Use masking tape to protect surfaces adjacent to recessed tooled joints.

6. Install joint sealants in accordance with ASTM C 1193 as applicable to materials, applications, conditions indicated, and with the following profile configurations:

    a. Fillet: Figure 5.
    b. Bridge: Figure 6.
    c. Butt: Figure 8A (concave tooling), generally hour-glass shape with 2:1 width-to-depth ratio.

C. Sprayed Foam Insulating Gap Filler: Apply sprayed foam insulating gap filler within exterior wall assemblies using professional hand-held dispensing gun in accordance with manufacturer's written instructions.

1. Prior to installation of wall finish systems, apply sprayed foam insulating gap filler to gaps, cracks, cavities, openings, and voids in exterior wall back-up, including annular space around piping, ducts, conduits, wiring, and electrical outlets to seal off potential air drafts.
2. After sprayed foam sealant is applied, make flush with face of adjacent wall by using method recommended by manufacturer.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall inspect first day's Work and periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

B. Field Adhesion Testing: Before installation, field test urethane and silicone sealant adhesion to joint substrates as follows:

1. General Requirements:

   a. Locate test joints where indicated or, if not indicated, as directed by Architect.
   b. Conduct field tests for each kind of urethane and silicone sealants and joint substrates indicated.
   c. Notify Architect 7 days in advance of dates and times when test joints will be erected.

2. Test Frequency: Perform 1 test for each 1000 ft (300 m) of joint length thereafter or 1 test for each floor at each elevation.
3. Test Methods: Joint sealant manufacturer's technical representative shall conduct following tests:

   a. When Joint Substrates are Identical: Test joint sealants according to ASTM C 1193, Method A (field-applied sealant joint hand pull tab) described below:

      1) Conduct one test and one additional test for each 1000 ft (300 m) of kind of joint sealant material and substrate conditions.
      2) Install 24 in (600 mm) long test specimens using same materials, methods for joint preparation, and joint sealant installation required for Work. Allow sealants to cure fully before testing.
      3) Make horizontal knife cut across width of sealant joint from one substrate to other substrate.
      4) Make 2 vertical cuts at both sides of substrates, downward starting at horizontal cut, approximately 3 in (75 mm) long.
      5) Grasp 3 in (75 mm) long piece of sealant tab firmly 1 in (25 mm) from its bonded edge and pull at not less than 90 degree angle.
      6) Substrate adhesion is acceptable if sealant tears cohesively within itself or elongates to a manufacturer determined extension value from 1 in (25 mm) gauge length before releasing from substrate adhesively.

   b. When Joint Substrates are Different: Test joint sealants according to ASTM C 1193, Method C (field-applied sealant joint hand pull flap) described below:

      1) Conduct one test and one additional test for each 1000 ft (300 m) of kind of joint sealant material and substrate conditions.
      2) Install 24 in (600 mm) long test specimens using same materials, methods for joint preparation, and joint sealant installation required for Work. Allow sealants to cure fully before testing.
      3) Make first horizontal knife cut across width of sealant joint from one substrate to other substrate.
      4) Make one vertical cut along one side of substrate, downward starting at horizontal cut, approximately 3 in (75 mm) long.
      5) Make second horizontal knife cut across width of sealant joint from one substrate to other substrate at opposite end of 3 in (75 mm) long first cut.
      6) Grasp 3 in (75 mm) long piece of sealant flap firmly and pull at not less than 90 degree angle.
      7) Substrate adhesion is acceptable if sealant tears cohesively within itself or elongates to a manufacturer determined extension value from 1 in (25 mm) gauge length before releasing from substrate adhesively.

4. Reports: Report which sealants and joint preparation methods resulted in optimum adhesion to joint substrates or whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each specimen. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
5. Evaluation of Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of non-compliance with requirements, will be considered satisfactory. Sealants failing to adhere to joint substrates during testing are not acceptable.

3.6 CLEANING

A. In-Progress Cleaning: Remove excess sealant or sealant smears adjacent to joints as Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.7 PROTECTION

A. General Requirements: Protect during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Material Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original Work.

3.8 JOINT SEALANT SCHEDULE

A. Exterior Elastomeric Sealant Applications:

1. Exterior Pourable Urethane Sealant:

    a. Moving joints in exterior concrete walks and drives.

2. Exterior Non-sag Silicone Sealant:

    a. Moving joints on exterior side of exterior walls.

B. Interior Elastomeric Sealant Applications:

1. Interior Non-sag Silicone Sealant:

    a. Non-moving joints in moist or damp areas which are susceptible to mildew.
    b. Non-moving joints in kitchens and toilet rooms.
    c. Non-moving joints in repeated contact with food.

2. Interior Non-sag Urethane Sealant:

    a. Building joints on interior side of exterior walls where joint movement is anticipated.

3. Interior Non-sag Acrylic Latex Sealant:

    a. Non-moving joints where another type of sealant is not otherwise specified or scheduled.
    b. Minimal moving joints due to temperature change.

C. Sprayed Foam Insulating Gap Filler Applications:

1. Exterior non-moving gaps around windows, glazed aluminum walls, doors, and penetrations beneath weather-resistant coverings.
2. Interior non-moving gaps around windows, glazed aluminum walls, doors, and penetrations.

END OF SECTION

SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Custom hollow metal doors and frames and supplementary items necessary for installation.

1.2 DEFINITIONS

A. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI/NAAMM-HMMA 861.

B. Exterior: Areas exposed to the elements and areas located in unconditioned spaces.

C. Interior: Areas located in conditioned spaces.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples for Verification Purposes: Submit 12 in by 12 in (300 mm by 300 mm) samples to demonstrate compliance with requirements for quality of materials and construction:

1. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
2. Frames: Show profile, head-to-jamb corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow metal panels and glazing if applicable.

D. Door and Frame Schedule: Schedule prepared by or under supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

E. Oversize Construction Certification: Documentation for assemblies required to be fire rated and exceeding limitations of labeled assemblies.

F. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

G. Qualification Data: For manufacturer and installer.

1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years, and with sufficient production capability, facilities, and personnel to produce required Work.

B. Installer Qualifications:

1. Experience: Installer with not less than 5 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years, and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project during times specified Work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

a. Owner.
b. Architect.
c. Contractor, including superintendent.
d. Installer, including project manager and supervisor.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Work requirements (drawings, specifications, and other Contract Documents).
c. Review required submittals, both completed and yet to be completed.
d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4 in (100 mm) high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4 in (6 mm) space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated and without permanent deformation or failure of materials.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

D. Smoke-Control Door Assemblies: Assemblies complying with NFPA 105 or UL 1784.

2.3 COMPONENT MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008 / A 1008M, Designation CS (Commercial Steel), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011 / A 1011M, Designation CS (Commercial Steel), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653 / A 653M, Designation CS (Commercial Steel), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating. Thickness indicated is for uncoated steel.

D. Frame Anchors: ASTM A 591 / A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008 / A 1008M or ASTM A 1011 / A 1011M, hot-dip galvanized according to ASTM A 153 / A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Device type and size required, hot-dip galvanized according to ASTM A 153 / A 153M, Class B.

F. Grout for Frame Installations in Masonry Partitions: ASTM C 476, except with maximum slump of 4 in (100 mm) according to ASTM C 143 / C 143M.

G. Mineral-Fiber Insulation for Installations in Sound-Rated Partitions: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6 to 12 lb/cu ft (96 to 192 kg/cu m) density; with following characteristics:

1. Flame-Spread Index: 25 maximum.
2. Smoke Development Index: 50 maximum.
3. Combustion Characteristics: Passing ASTM E 136.

H. Glazing: Comply with Division 08 Section "Glazing".

I. Primer: Fast-curing, corrosion-inhibiting, lead and chromate free, universal primer complying with ANSI A224.1 acceptance criteria; compatible with substrate and field-applied finish paint system specified in Division 09 Section "Painting".

J. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing minimum of 94 percent zinc dust by weight.

2.4 FABRICATION, GENERAL

A. Fabrication Quality Standard: ANSI/NAAMM-HMMA 861.

B. General Requirements: Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit, and assemble units in manufacturer's plant.

C. Accessories: Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to templates furnished as specified in Division 08 Section "Door Hardware".

1. Locate hardware according to ANSI/NAAMM-HMMA 861.
2. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.5 HOLLOW METAL DOORS

A. Fabrication Provisions: Fabricate doors not less than 1-3/4 in (44 mm) thick, of seamless hollow construction unless otherwise indicated. Construct doors with smooth surfaces without visible joints or seams on exposed faces.

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.

B. Door Face Sheets:

1. Metallic-coated steel sheet, minimum 0.053 in (1.3 mm) (16 gage) thick for doors in the following locations:

   a. Exterior doors.

2. Cold-rolled steel sheet, minimum 0.042 in (1.10 mm) (18 gage) thick for doors in the following locations:

   a. Interior doors.

C. Core Construction:

1. Steel-Stiffened Core: 0.026 in (0.7 mm) (22 gage) thick, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 in (150 mm) apart, spot welded to face sheets a maximum of 5 in (125 mm) on centers. Spaces filled between stiffeners with mineral-fiber insulation.
2. Fire Door Core: As required to provide fire-protection indicated.
3. Thermal-Rated (Insulated) Core: Typical at Exterior doors and otherwise indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F by h by sq ft/Btu (0.704 K by sq m/W) according to ASTM C 1363.

D. Vertical Edges:

1. Single Acting Doors: Beveled 1/8 in in 2 in (3 mm in 50 mm).
2. Double Acting Doors: Round vertical edges with 2-1/8 in (53 mm) radius.

E. Top and Bottom Channels: Closed with continuous channels, minimum 0.053 in (1.3 mm) (16 gage) thick, of same material as face sheets and spot welded to both face sheets.

1. Spot weld metal channel not more than 6 in (150 mm) on center.

F. Hardware Reinforcement: Fabricate from same material as door. Minimum thickness of steel reinforcing plates for following hardware:

1. Hinges and Pivots: 0.167 in (4.2 mm) (7 gage) thick by 1-1/2 in wide by 6 in (38 mm by 150 mm) longer than hinge, secured by not less than 6 spot welds.
2. Strikes, Flush Bolts, and Closers: 0.093 in (2.3 mm) (12 gage).
3. Surface-Mounted Hold-Open Arms and Panic Devices: 0.093 in (2.3 mm) (12 gage).

G. Glass Molding and Stops: Provide frame for glazed openings between face sheets continuously around perimeter of glass opening and weld to face sheets.

1. Form frame with integrally formed stop on security side.
2. Miter corners, weld, and grind smooth.
3. Do not overlap frame molding on face of door.
4. Use same materials as door face sheet for frame and loose stop for flush glazing.

H. Louvers: Stationary louvers constructed with inverted V-shaped or Y-shaped blades with blades or baffles and frame formed of same materials as door face sheet. Fabricate louvers and mount flush into doors without overlapping moldings on surface of door face sheets. Provide internal support recommended by manufacturer. Provide louvers with minimum of 50% free air area.

1. Automatic Louvers at Fire-Rated Doors: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same testing and inspecting agency that established fire-resistance rating of door assembly.

2.6 HOLLOW METAL FRAMES

A. Fabrication Provisions:

1. Fabricate frames of construction indicated below.
2. Close contact edges of corner joints tight with faces mitered and full-profile continuously welded.

    a. "Knock-down" frame construction is not acceptable and shall not be used.

3. Close contact edges of stops butted or mitered.
4. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

B. Joinery:

1. Fabrication Quality Standard: Head-to-jamb joints according to ANSI/NAAMM-HMMA 820 for either of following fabrication techniques with:

    a. Saw-mitered corners, full-profile continuously welded.
    b. Machine-mitered corners, full-profile continuously welded.

2. Externally or internally weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and seamless.
3. Internally weld rabbet and soffits continuously; grind, fill, dress, and make smooth.
4. Use of gusset or splice plates as substitute for fully welding is not permitted.

C. Materials and Thickness:

1. Metallic-coated steel sheet, 0.067 in (1.7 mm) (14 gage) thick for frames in the following locations:

   a. Exterior frames.

2. Cold-rolled steel sheet for frames in the following locations:

   a. Interior frames.

3. Thickness for Cold-Rolled Steel Sheet Frames:

   a. 48 in (1200 mm) Wide or Less: 0.053 in (1.3 mm) (16 gage) thick.
   b. More than 48 in (1200 mm) Wide: 0.067 in (1.7 mm) (14 gage) thick.

4. Sidelight and Transom Frames: Closed tubular members with no visible face seams or joints fabricated from same type and thickness of material as adjacent door frame.
5. Interior Borrowed-Light Frames: Fabricated from 0.053 in (1.3 mm) (16 gage) thick cold-rolled steel sheet.

D. Stops and Moldings:

1. Form corners with butted or mitered hairline joints.
2. Provide around glazed lites where indicated.

   a. Fixed frame moldings on outside of exterior doors and frames and on secure side of interior doors and frames.
   b. Loose stops and moldings on inside of hollow metal work so that glass can be removed independently.

3. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

E. Grout Guards for Frame Installations in Masonry Partitions: At back of hardware cutouts, install 0.016 in (0.4 mm) (26 gage) thick grout guards or dust-cover boxes of same material as frame, welded to frame to close off interior of openings and prevent grout or other materials from obstructing hardware operation.

F. Hardware Reinforcement: Fabricate from same material as frame. Minimum thickness of steel reinforcing plates for following hardware:

1. Hinges and Pivots: 0.167 in (4.2 mm) (7 gage) thick by 1-1/2 in wide by 6 in (38 mm by 150 mm) longer than hinge, secured by not less than 6 spot welds.
2. Strikes, Flush Bolts, and Closers: 0.093 in (2.3 mm) (12 gage).
3. Surface-Mounted Hold-Open Arms and Panic Devices: 0.093 in (2.3 mm) (12 gage).

G. Head Reinforcement: Provide minimum 0.093 in (2.3 mm) (12 gage) thick, steel channel or angle stiffener for opening widths more than 48 in (1200 mm).

H. Jamb Anchors:

1. Types: Fabricated of same material as frame:

   a. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 in (1.10 mm) (18 gage) thick.
   b. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 in (1.10 mm) (18 gage) thick, with corrugated or perforated straps not less than 2 in (50 mm) wide by 10 in (250 mm) long.
   c. Postinstalled Expansion Type for In-Place Concrete or Masonry: Countersunk, flat or oval head exposed screws and bolts with expansion shields or inserts, minimum 3/8 in (10 mm) diameter bolts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

2. Quantity and Location:

   a. Stud-Wall Type: Locate anchors not more than 18 in (450 mm) from top and bottom of frame. Space anchors not more than 32 in (800 mm) on centers and as follows:

      1) Three anchors per jamb up to 60 in (1500 mm) high.
      2) Four anchors per jamb from 60 to 90 in (1500 to 2250 mm) high.
      3) Five anchors per jamb from 90 to 96 in (2250 to 2400 mm) high.
      4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 in (600 mm) or fraction thereof above 96 in (2400 mm) high.
      5) Two anchors per head for frames above 42 in (1050 mm) wide and mounted in metal-stud partitions.

   b. Masonry Type: Locate anchors not more than 18 in (450 mm) from top and bottom of frame. Space anchors not more than 32 in (800 mm) on centers and as follows:

      1) Two anchors per jamb up to 60 in (1500 mm) high.
      2) Three anchors per jamb from 60 to 90 in (1500 to 2250 mm) high.
      3) Four anchors per jamb from 90 to 120 in (2250 to 3000 mm) high.
      4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 in (600 mm) or fraction thereof above 120 in (3000 mm) high.

   c. Postinstalled Expansion Type for In-Place Concrete or Masonry: Locate anchors not more than 6 in (150 mm) from top and bottom of frame and not more than 26 in (650 mm) on centers.

I. Floor Anchors: Formed from same material as frames welded to bottom of jambs and mullions with not less than 4 spot welds, not less than 0.0428 in (1.10 mm) (18 gage) thick, and as follows, terminating bottom of frames at finish floor surface:

1. Monolithic Concrete Slabs: Clip type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable type anchors with extension clips, allowing not less than 2 in (50 mm) height adjustment.

J. Shipping Spreader Bars: Attach two removable metal spreader bars across bottom of frames, tack welded to jambs and mullions.

K. Head Strut Supports: When top of frame is in same plane as ceiling, provide 3/8 in thick by 2 in (10 mm thick by 50 mm) wide vertical steel struts extending from top of frame at each jamb to supporting construction above. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.

L. Door Silencers: Except on weatherstripped doors, drill holes to receive door silencers furnished under Division 08 Section "Door Hardware". Keep holes clear during construction.

1. Single-Door Frames: Strike jamb for 3 door silencers.
2. Double-Door Frames: Head jamb for 2 door silencers.

2.7 STEEL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for cleaning, treating, priming, and when specified, finishing.

B. Finish products specified in this Section after fabrication.

C. Metallic-Coated Steel Surface Preparation: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to primer to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Non-Coated Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

E. Prime Coat Finish: Apply manufacturer's standard primer specified below immediately after surface preparation and pretreatment.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

F. Field-Applied Coatings: As specified in Division 09 Section "Painting".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. ANSI/NAAMM-HMMA 840.
2. NFPA 80 for fire-rated doors and frames.
3. DHI A115.IG.
4. Respective manufacturer's written installation instructions.
5. Accepted submittals.
6. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Pre-Installation Tolerances: Prior to installation, adjust and securely brace hollow metal frames for squareness, alignment, twist, and plumbness to following:

1. Squareness: Plus or minus 1/16 in (1.5 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 in (1.5 mm), measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 in (1.5 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 in (1.5 mm), measured at jambs on a perpendicular line from head to floor.

C. Hardware Preparation: Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.4 INSTALLATION OF HOLLOW METAL DOORS AND FRAMES

A. Hollow Metal Frames: Install hollow metal frames of size and profile indicated.

1. Setting: Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and welded-in shipping spreader bars. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

    a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    b. Install frames with removable glazing stops located on secure side of opening.
    c. Install door silencers in frames before grouting.
    d. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors or powder actuated fasteners.
3. Sound-Rated Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.

4. New Masonry and Concrete Walls: Solidly fill space between frames and masonry and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
5. In-Place Masonry or Concrete Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. Installation Tolerances: Adjust hollow metal frames for squareness, alignment, twist, and plumb to following:

    a. Squareness: Plus or minus 1/16 in (1.5 mm), measured at rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 in (1.5 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 in (1.5 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 in (1.5 mm), measured at jambs at floor.

B. Hollow Metal Doors: Provide insulated doors at exterior and non-insulated at interior locations. Fit accurately in frames, within following clearances:

1. Jambs and Head: 1/8 in (3 mm) plus or minus 1/16 in (1.5 mm).
2. Between Edges of Pairs of Doors: 1/8 in (3 mm) plus or minus 1/16 in (1.5 mm).
3. Between Bottom of Door and Top of Threshold: Maximum 3/8 in (10 mm).
4. Between Bottom of Door and Top of Finish Floor Covering or Top of Structure (No Threshold): Maximum 3/8 in (10 mm).

C. Glazing:

1. Comply with installation requirements in Division 08 Section "Glazing".
2. Secure stops with countersunk flat or oval head machine screws spaced uniformly not more than 6 in (150 mm) on center and not more than 2 in (50 mm) on centers from each corner.

3.5 ADJUSTMENTS

A. Final Adjustments: Remove and replace defective hollow metal work, including work that is warped, bowed, or otherwise unacceptable.

B. Prime Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of primer compatible with paint specified in Division 09 Section "Painting".

C. Metallic-Coated Surfaces: Prepare and repair damaged galvanized coatings on fabricated and installed hollow metal work with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

D. Field-Applied Coatings: As specified in Division 09 Section "Painting".

END OF SECTION

SECTION 08 1416

PREFINISHED FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Prefinished flush wood doors and supplementary items necessary for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Include details of core and edge construction, light frames, and trim for openings.
3. Include factory-finishing specifications.
4. Include manufacturer's surface preparation instructions.
5. Indicate scheduled fire doors that cannot qualify for labeling because of design, size, hardware or other reason.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Provide dimensioned drawings indicating location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for door face matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire-protection-ratings for fire-rated doors.

C. Samples for Verification Purposes: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Wood Veneer Doors: Wood veneer factory finishes applied to actual door face materials, approximately 8 in by 10 in (200 mm by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of 3 samples showing typical range of color and grain to be expected in finished work.
2. Corner sections of doors, approximately 8 in by 10 in (200 mm by 250 mm), with door faces and edges representing actual materials to be used.

a. Wood Veneer Doors: Samples for each species of wood veneer and solid lumber required.
b. Finish door facing samples with same materials proposed for factory-finished doors.

3. Light Frames: Frames for light openings, 6 in (150 mm) long, for each material, type, and finish required.

D. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

E. Warranty: Sample of warranty.

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

F. Maintenance Data: To include in maintenance manuals.

1.3 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

a. Owner.
b. Architect.
c. Contractor, including superintendent.
d. Installer, including project manager and supervisor.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Work requirements (Drawings, Specifications, and other Contract Documents).
c. Review required submittals, both completed and yet to be completed.
d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
e. Review required inspection, testing, certifying, and material usage accounting procedures.
f. Review environmental conditions and procedures for coping with unfavorable conditions.
g. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.4 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with requirements of referenced quality standards and manufacturer's written instructions.

1. Package doors individually.
2. Protect doors during transit, storage and handling to prevent damage, soiling and deterioration.
3. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Deliver and install doors only when spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.6 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.7 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. Warranty shall also include finishing that may be required due to repair or replacement of defective doors. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Defects include, but are not limited to, the following:

a. Warping (Bow, Cup, or Twist): Not more than 1/4 in (6 mm) in a 42 by 84 in (1050 by 2100 mm) section.
b. Telegraphing of Core Construction: Not more than 0.01 in in a 3 in (0.25 mm in a 75 mm) span in face veneers.

2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period as follows:

a. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Provide product by one of manufacturers listed.

1. Algoma Hardwoods, Inc.
2. Eggers Industries.
3. Marshfield Door Systems, Inc.
4. Mohawk Flush Doors, Inc.; a Masonite Company.
5. Oshkosh Architectural Door Company.

6. VT Industries Inc.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Fire Resistance Ratings: Products and construction identical to assemblies tested for fire resistance according to NFPA 252 or UL 10C and included under Category GSZN, Category A, published in Underwriters Laboratories, Inc. (UL) "Fire Resistance Directory".
2. Positive Pressure Testing: After 5 minutes into test, neutral pressure level in furnace shall be established at 40 in (1000 mm) or less above sill.
3. Availability: If specified as fire-rated and labeled door can be obtained from one manufacturer, no consideration will be given to those manufacturers who are not authorized to manufacture such doors.
4. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

2.4 DOOR CONSTRUCTION, GENERAL

A. Product Quality Standard: In addition to standard listed elsewhere, comply with following, unless otherwise specified, for construction, finishes, installation, and other requirements:

1. Standard: AWI's "Architectural Woodwork Quality Standards".
2. Certification: Issue trade association's certification indicating wood doors and installation comply with requirements of grades specified.

B. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

C. Particleboard Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-2.
2. Blocking: Solid wood blocking as needed to eliminate through-bolting hardware and as follows:

a. Top Rail: 5 in (125 mm).
b. Bottom Rail: 5 in (125 mm).
c. Mid Rail: 5 in (125 mm), in doors indicated to have exit devices.
d. Lock Blocks: 5 in by 10 in (125 mm by 250 mm), one for lock and two for exit devices.

D. Fire-Protection-Rated Doors: Mineral core as required for fire-protection-rating indicated.

1. Edge: Construction with intumescent seals; where positive pressure fire testing is required, edge construction with intumescent seals concealed by outer stile matching door face material and laminated backing at hinge stiles for improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
2. Pairs: Fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Comply with specified requirements for exposed edges.

E. Mineral Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection-rating indicated.
2. Blocking: Composite blocking with improved screw-holding capability approved for use in doors of fire-protection-ratings indicated as needed to eliminate through-bolting hardware and as follows:

    a. Top Rail: 5 in (125 mm).
    b. Bottom Rail: 5 in (125 mm).
    c. Mid Rail: 5 in (125 mm), in doors indicated to have exit devices.
    d. Lock Blocks: 5 in by 10 in (125 mm by 250 mm), one for lock and two for exit devices.

2.5 WOOD VENEER FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade AA wood veneer faces.
2. Species and Cut Selection: As indicated in Finish Legend.

    a. Matching of Adjacent Veneer Leaves: Book or Slip match.
    b. Assembly of Veneer Leaves on Door Faces: Balance or Center-Balance match.
    c. Room Match: Match door faces within each separate room or area of building. Corridor door faces do not need to match where they are separated by not less than 20 ft (6 m) or more.
    d. Pair and Set Match: For doors hung in same opening or separated only by mullions.

3. Exposed Vertical Edges: Same wood veneer as face veneer with sanded eased edges.
4. Horizontal Edges: Unfaced, sanded smooth, with factory applied seal coat.
5. Core: Particleboard or mineral core as required by application.
6. Construction: 5 plies.

    a. Stiles and rails bonded to core.
    b. Entire unit abrasive planed before veneering.
    c. Faces bonded to core using a hot press.

2.6 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors:

1. Description: Manufacturer's standard wood beads and profile. At wood-core doors with 20-minute fire protection ratings, provide wood beads and metal glazing clips approved for such use.
2. Material and Finish: Same veneer species and finish as door faces.
3. Glass: As specified in Division 08 Section "Glazing".

B. Wood Veneered Beads for Light Openings in Fire-Rated Doors:

1. Description: Manufacturer's standard wood veneered, noncombustible beads approved for use in doors of fire protection rating indicated. Include concealed metal glazing clips where required for opening size and fire protection rating indicated.
2. Material and Finish: Same veneer species and finish as door faces.
3. Glass: As specified in Division 08 Section "Glazing".

2.7 FABRICATION OF PREFINISHED FLUSH WOOD DOORS

A. Fabrication Quality Standards: In addition to standards listed elsewhere, comply with following, unless otherwise specified:

1. NFPA 80 for fire-rated doors.
2. DHI-WDHS-3 and DHI A115-W series standards for hardware.

B. Factory Fitting: Factory fit doors to suit frame opening sizes indicated according to installation quality standards. Do not trim stiles and rails in excess of limits permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining with seal coat.

1. Maximum Clearances for non-rated doors:

   a. Head, Jambs, and Between Pairs of Doors: 1/8 in (3 mm).
   b. Bottom to Top of Floor Coverings: 1/2 in (12 mm).
   c. Bottom to Top of Raised Threshold: 3/8 in (10 mm).

2. Bevel (Doors without Replaceable Secondary Door Stiles): 1/8 in in 2 in (3 mm in 50 mm) (3-1/2 deg) at lock and hinge edges; at fire-rated doors trim stiles and rails only to extent permitted by labeling agency.

C. Hardware:

1. Factory machine doors for hardware that is not surface applied according to installation quality standards.
2. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
3. For doors scheduled to have electrical locks, provide built-in 1/4 in (6 mm) diameter raceway through doors, from lockset location to nearest hinge location, for low voltage wiring for doors scheduled to have electric locks.

D. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing".

2.8 FACTORY FINISHING OF DOORS

A. General:

1. Comply with referenced quality standard for factory finishing.
2. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
3. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on edges of cutouts and mortises.

B. Grade: Provide finishes of same grades as items to be finished.

C. Wood Veneer Faced Doors for Transparent Finish:

1. Finish: As follows:

a. Grade: Premium.
b. Product Quality Standard Finish Designation: AWI conversion varnish system.
c. Staining: None.
d. Effect: Filled finish.
e. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF FLUSH WOOD DOORS

A. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

1. Fire-Rated Doors: Install doors in corresponding fire-rated frames according to NFPA 80.
2. Smoke-Control Doors: Install doors according to NFPA 105.

B. Hardware: As specified in Division 08 Section "Door Hardware".

C. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.5 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 08 3113

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes access doors and frames in walls, floors, and ceilings, and supplementary items necessary to complete their installation:

B. Roof hatches are specified in Division 07 Section "Roof Accessories".

1.2 SUBMITTALS

A. Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required).

B. Shop Drawings: Show fabrication and installation details of customized doors and frames. Include plans, elevations, sections, details, and attachments to other Work.

C. Schedule: Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.

D. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items with concealed framing, suspension systems, piping, ductwork, and other construction. Show the following:

1. Method of attaching door frames to surrounding construction.
2. Ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain doors and frames through one source from a single manufacturer.

B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics that are labeled and listed by UL or ITS.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.4 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Acudor Products, Inc.
2. Cierra Products.
3. J. L. Industries, Inc.
4. Karp Associates, Inc.
5. Larsen's Manufacturing Company.
6. Milcor Limited Partnership.
7. Nystrom Building Products Co.
8. Williams Bros. Corporation of America (The).

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36.

B. Cold-Rolled Steel Sheets: ASTM A 366, Commercial Steel (CS), or ASTM A 620, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568. Electrolytic zinc-coated steel sheet, complying with ASTM A 591, Class C coating, may be substituted at fabricator's option.

C. Metallic-Coated Steel Sheet: ASTM A 653, Commercial Steel (CS), Type B, with A60 zinc-iron-alloy (galvannealed) coating or G60 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924.

D. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304; with minimum sheet thickness indicated representing specified thickness according to ASTM A 480 with No. 4 satin finish.

E. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

F. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.3 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2.4 ACCESS DOORS AND FRAMES

A. Flush, Insulated, Fire-Rated Doors with Exposed Frame:

1. Metal: Steel, metallic-coated steel or stainless-steel sheet as scheduled.
2. Locations: Masonry and Ceramic-tile wall surfaces.
3. Fire-Resistance Rating: One and one-half hours.
4. Temperature Rise Rating: 250 deg F at the end of 30 minutes.

5. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
6. Frame: Minimum 0.060-inch-thick sheet metal with 1-inch- to 1-1/2-inch-wide, surface-mounted trim.
7. Hinges: Continuous piano hinge.
8. Automatic Closer: Spring type.
9. Latch: Self-latching bolt operated by key with interior release.
10. Size: 12 inch by 12 inch unless otherwise indicated.
11. Product Standard: Nystrom Building Products, model IT.

B. Flush, Insulated, Fire-Rated Doors with Trimless Frames:

1. Metal: Steel, metallic-coated steel or stainless-steel sheet as scheduled.
2. Locations: Gypsum board wall surfaces.
3. Fire-Resistance Rating: One and one-half hours.
4. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
5. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
6. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead.
7. Hinges: Continuous piano hinge.
8. Automatic Closer: Spring type.
9. Latch: Self-latching bolt operated by key with interior release.
10. Size: 12 inch by 12 inch unless otherwise indicated.
11. Product Standard: Nystrom Building Products, model IW or IP as applicable.

C. Flush Doors with Exposed Frames:

1. Metal: Steel, metallic-coated steel or stainless-steel sheet as scheduled.
2. Locations: Masonry and Ceramic-tile wall surfaces.
3. Door: Minimum 0.075-inch-thick sheet metal, set flush with exposed face flange of frame.
4. Frame: Minimum 0.060-inch-thick sheet metal with 1-inch- to 1-1/4-inch-wide, surface-mounted trim.
5. Hinges: Continuous piano hinge.
6. Lock: Key-operated cylinder lock.
7. Size: 12 inch by 12 inch unless otherwise indicated.
8. Product Standard: Nystrom Building Products, model NT.

D. Flush Doors with Trimless Frames:

1. Metal: Steel, Metallic-coated steel or stainless-steel sheet as scheduled.
2. Locations: Gypsum board wall and ceiling surfaces.
3. Door: Minimum 0.075-inch-thick sheet metal, set flush with surrounding finish surfaces.
4. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead.
5. Hinges: Continuous piano hinge.
6. Lock: Key-operated cylinder lock.
7. Size: 12 inch by 12 inch unless otherwise indicated.
8. Product Standard: Nystrom Building Products, model NW or NP as applicable.

2.5 FABRICATION

A. General: Provide access door assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Steel Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Provide mounting holes in frames to attach frames to metal framing in metal stud construction and to attach masonry anchors in masonry construction.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Metallic-Coated Steel Finishes:

1. Galvanizing: Hot-dip galvanize items indicated to comply with applicable standard listed below:

a. ASTM A 123/A 123M, for galvanizing steel and iron products.
b. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

2. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. For galvanized surfaces, apply, after cleaning, a conversion coating suited to the organic coating to be applied over it. For metallic-coated surfaces, clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
3. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
4. Factory Priming for Field-Painted Finish: Apply shop primer immediately after cleaning and pretreating.

D. Steel Finishes:

1. Surface Preparation: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

a. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
b. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

2. Apply shop primer to uncoated surfaces of metal fabrications. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

E. Stainless-Steel Finishes:

1. Remove tool and die marks and stretch lines or blend into finish.
2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
3. Bright, Directional Polish: No. 4 finish. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 PREPARATION

A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

3.4 SCHEDULE

A. Provide access doors, where indicated on the drawings, and where scheduled below.

1. Provide access doors at concealed valves and controls for plumbing and HVAC.
2. Provide fire rated access doors at rated walls and ceilings.
3. Provide access doors at fire dampers above non-accessible ceilings.
4. Provide access doors to motor operated doors and grilles above non-accessible ceilings.
5. Provide zinc coated steel access doors at exterior locations.
6. Provide stainless steel access doors at ceramic tile and other damp locations.

END OF SECTION

SECTION 08 3313

OVERHEAD COILING COUNTER DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes overhead coiling counter doors including supplementary items necessary to complete the Work required for their installation.

B. Provide complete operating shutter assemblies including curtains, guides, counterbalance mechanism, hardware, operators, and installation accessories.

C. Electrical service and connections for powered operators and accessories are specified in Division 26.

1.2 PERFORMANCE REQUIREMENTS

A. Operation-Cycle Requirements: Design overhead coiling counter shutter components and operator to operate for not less than 20,000 cycles.

1.3 SUBMITTALS

A. Product Data: For each type and size of overhead coiling counter shutter and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:

1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
2. Summary of forces and loads on walls and jambs.
3. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.
4. Fire-Rated Shutters: Information describing fire-release system, including testing and resetting instructions.

B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.

C. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by shutter manufacturer and those provided by others.

D. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

E. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the overhead coiling shutter manufacturer for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling shutters through one source from a single manufacturer. Obtain accessories from the overhead coiling shutter manufacturer.

C. Fire-Rated Shutter Assemblies: Provide assemblies complying with NFPA 80 that are identical to shutter and frame assemblies tested for fire-test-response characteristics per UL 10b, and that are labeled and listed for fire ratings indicated by UL, FM, or ITS/Warnock Hersey.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. The Cookson Company.
2. Cornell Iron Works Inc.
3. Mahon Door Corp.
4. McKeon Rolling Steel Door Company, Inc.
5. Overhead Door Corporation.
6. Pacific Rolling Door Co.
7. Raynor Garage Shutters.
8. Southwestern Steel Rolling Door Co.
9. Wayne-Dalton Corp.
10. Windsor Door; A United Dominion Company.

2.2 SHUTTER CURTAIN MATERIALS

A. Curtain: Manufacturers standard flat-profile interlocking slats, designed to withstand required wind loading, in a continuous length for width of opening without splices. Provide slats of material thickness recommended by shutter manufacturer for performance, size, and type of shutter indicated, and as follows:

1. Stainless-Steel Curtain Slats: ASTM A 240 or ASTM A 666. Type 300 series.

B. Endlocks: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

C. Bottom Bar: Manufacturer's standard continuous or tubular shape, either stainless steel or aluminum extrusions to suit type of curtain slats.

1. Astragal: Provide a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene, between angles or fitted to shape, as a cushion bumper.

D. Curtain Jamb Guides: Fabricate curtain jamb guides of angles, or channels and angles of material and finish to match curtain slats, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Provide continuous integral wear strips to prevent metal-to-metal contact and minimize noise of travel and removable stops on guides to prevent overtravel of curtain.

2.3 ACCESSORIES

A. Integral Frame, Hood, and Fascia: Provide welded assemblies of the following sheet metal:

1. Fabricate of not less than 0.0625-inch-thick, stainless-steel sheet, Type 300 series, complying with ASTM A 240 or ASTM A 666.

B. Integral Sills: Fabricate sills as integral part of frame assembly of same sheet metal, but not less than 0.078-inch-thick.

C. Smoke Seals: Provide UL-listed and -tested smoke-seal perimeter gaskets.

D. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks, operable from inside only.

1. Lock cylinder is specified in Division 08 Section, "Door Hardware".

E. Provide automatic-closing device inoperative during normal counter shutter operations, with governor unit complying with requirements of NFPA 80, with easily tested and reset release mechanism, and designed to be activated by the following:

1. Building fire alarm and detection system and shutter-holder-release devices.
2. Provide time delay release device similar to Overhead Door Corp. "Fire Sentinel Model FS-C" for easy test and reset operation.

2.4 COUNTERBALANCING MECHANISM

A. General: Counterbalance shutters by means of adjustable-tension steel helical torsion spring, mounted around a steel shaft and contained in a spring barrel connected to curtain with required barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.

D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast-iron or cold-rolled steel plate with bell-mouth guide groove for curtain.

2.5 FINISHES, GENERAL

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 STAINLESS-STEEL FINISHES

A. Remove or blend tool and die marks and stretch lines into finish.

B. Grind and polish surfaces to produce uniform, directional textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Polish: No. 4 finish.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.7 ELECTRIC SHUTTER OPERATORS

A. General: Provide electric shutter operator assembly of size and capacity recommended and provided by shutter manufacturer for shutter and operational life specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking shutter, and accessories required for proper operation. Comply with NFPA 70.

B. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging sprocket-chain operator and releasing brake for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level.

1. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
2. Provide safety interlock switch to disengage power supply when shutter is locked.

C. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

D. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.

E. Door-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft, gear-head hoist-type shutter operator unit consisting of electric motor, enclosed worm-gear running-in-oil primary drive, chain and sprocket secondary drive, and auxiliary chain-hoist and floor level disconnect.

F. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate shutter in either direction, from any position, at not less than 2/3 fps or more than 1 fps, without exceeding nameplate ratings or considering service factor.

1. Type: Polyphase, medium-induction type.
2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
3. Coordinate wiring requirements and electric characteristics of motors with building electrical system.
4. Provide open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.

G. Remote-Control Station: Provide momentary-contact, 3-button control station with push-button controls labeled "Open," "Close," and "Stop." Locate on interior side adjacent to shutter.

1. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

H. Obstruction Detection Device: Provide each motorized shutter with indicated external automatic safety sensor able to protect full width of shutter opening. Activation of sensor immediately stops and reverses downward shutter travel.

1. Sensor Edge: Provide each motorized shutter with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

a. Provide electrically actuated automatic bottom bar.
b. Provide self-monitoring, 4-wire configured device.

I. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop shutter at fully opened and fully closed positions.

J. Provide electric operators with ADA-compliant audible alarm and visual indicator lights.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive overhead coiling counter doors and associated work and conditions under which work will be installed. Do not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the Installer. Starting of work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 INSTALLATION

A. General: Install shutter and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.

1. Install fire-rated shutters to comply with NFPA 80.

B. Lubricate bearings and sliding parts; adjust shutters to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

3.3 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

a. Test shutter closing when activated by detector or alarm connected fire-release system. Reset closing mechanism after successful test.

2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance, and procedures for testing and resetting release devices.
3. Review data in the maintenance manuals. Refer to Division 01 Section "Closeout Procedures."

END OF SECTION

SECTION 08 3326

OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes overhead coiling grilles, and supplementary items necessary to complete work required for their installation.

B. Provide complete operating grille assemblies including grilles curtains, guides, counterbalance mechanism, hardware, operators, and installation accessories.

C. Electrical service and connections for powered operators are specified in Division 26.

1.2 PERFORMANCE REQUIREMENTS

A. Operation-Cycle Requirements: Design overhead coiling grille components and operator to operate for not less than 20,000 cycles.

1.3 SUBMITTALS

A. Product Data: For each type and size of overhead coiling grille and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:

1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
2. Summary of forces and loads on walls and jambs.
3. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.

B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.

C. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by grille manufacturer and those provided by others.

D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the overhead coiling grille manufacturer for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling grilles through one source from a single manufacturer. Obtain accessories from the overhead coiling grille manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. The Cookson Company.
2. Cornell Iron Works, Inc.
3. Mahon Door Corp.
4. McKeon Rolling Steel Door Company, Inc.
5. Overhead Door Corporation.
6. Pacific Rolling Door Co.
7. Raynor Garage Doors.
8. Wayne-Dalton Corp.
9. Windsor Door; A United Dominion Company.

2.2 GRILLE CURTAIN MATERIALS AND CONSTRUCTION

A. General: Fabricate overhead coiling grille curtain consisting of a network of 5/16-inch- minimum diameter horizontal rods, or rods covered with tube spacers, spaced as indicated. Interconnect rods by vertical links approximately 5/8-inch-wide, spaced as indicated and rotating on rods.

1. Space rods at approximately 2 inches o.c.
2. Space links in line at approximately 9 inches apart.
3. Aluminum Grilles: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Endlocks: Continuous end links, chains, or other devices at ends of rods, locking and retaining grille curtain in guides against excessive pressures, maintaining curtain alignment, and preventing lateral movement.

C. Bottom Bar: Manufacturer's standard continuous channel, tubular shape, or 2 angles, finished to match grille.

1. Astragal: Provide a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene, between angles or fitted to shape, as a cushion bumper for interior grille.
2. Provide motor-operated grilles with combination bottom astragal and sensor edge.

D. Curtain Jamb Guides: Manufacturer's standard extruded-aluminum shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and minimize noise of travel. Provide removable stops on guides to prevent overtravel of curtain.

2.3 ACCESSORIES

A. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.

1. Aluminum Grilles: Fabricate aluminum hoods, complying with ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and not less than 0.032-inch-thick.
2. Shape: Square.

B. Push/Pull Handles: Provide lifting handles on each side of grille. Provide pull-down straps or pole hooks for grilles more than 84 inches high.

C. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks, operable from inside (non-secure side) only unless indicated otherwise.

1. Locking device assembly shall be operable from outside (secure side) at Parts Storage.
2. Lock cylinder is specified in another Division 08 Section, "Door Hardware".

2.4 COUNTERBALANCING MECHANISM

A. General: Counterbalance grille by means of adjustable-tension steel helical torsion spring, mounted around a steel shaft and contained in a spring barrel connected to the curtain. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of curtain and to limit barrel deflection to not more than 0.03 in./ft of span under full load.

C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.

D. Fabricate torsion rod for counterbalance shaft of case-hardened steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast-iron or cold-rolled steel plate.

2.5 FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Finishes: Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

1. Manufacturer's standard mill finish.

2.6 ELECTRIC GRILLE OPERATORS

A. General: Provide electric grille operator assembly of size and capacity recommended and provided by grille manufacturer for grille and operational life specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking grille, and accessories required for proper operation. Comply with NFPA 70.

B. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging sprocket-chain operator and releasing brake for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level.

1. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
2. Where grille unit is power operated, provide safety interlock switch to disengage power supply when grille is locked.

C. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

D. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.

E. Grille-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft, gear-head-type grille operator unit consisting of electric motor, enclosed worm-gear running-in-oil primary drive, chain and sprocket secondary drive, and quick disconnect-release for manual operation.

F. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate grille in either direction, from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or considering service factor.

1. Type: Polyphase, medium-induction type.
2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
3. Coordinate wiring requirements and electric characteristics of motors with building electrical system.
4. Provide open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.

G. Remote-Control Station: Provide momentary-contact, 3-button control station with push-button controls labeled "Open," "Close," and "Stop" and "On-Off" key switch.

1. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

H. Obstruction Detection Device: Provide each motorized grille with indicated external automatic safety sensor able to protect full width of grille opening. Activation of sensor immediately stops and reverses downward grille travel.

1. Sensor Edge: Provide each motorized grille with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward grille travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

a. Provide electrically actuated automatic bottom bar.
b. Self-Monitoring Type: Provide self-monitoring, 4-wire configured device.

I. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop grille at fully opened and fully closed positions.

J. Provide electric operators with ADA-compliant audible alarm and visual indicator lights.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive overhead coiling grilles and associated work and conditions under which work will be installed. Do not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the Installer. Starting of work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 INSTALLATION

A. General: Install grilles and operating equipment complete with necessary hardware, according to Shop Drawings, manufacturer's written instructions, and as specified.

B. Lubricate bearings and sliding parts; adjust grilles to operate easily, free from warp, twist, or distortion and fitting tight for entire perimeter.

3.3 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below.

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance, and procedures for testing and resetting release devices.
3. Review data in the maintenance manuals. Refer to Division 01 Section "Operation and Maintenance Data."

END OF SECTION

SECTION 08 3613

SECTIONAL OVERHEAD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes sectional overhead doors, including supplementary items necessary to complete the Work required for their installation.

B. Provide complete operating door assemblies including door panels, tracks, counterbalance mechanisms, hardware, operators and installation accessories.

C. Electrical service and connections for power operators and accessories are specified in Division 26.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide sectional overhead doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:

1. Wind Load: Uniform pressure acting inward and outward as required by local building code and Design Wind Pressure Schedule.

B. Operation-Cycle Requirements: Design sectional overhead door components and operator to operate for not less than 20,000 cycles and for 10 cycles per day.

1.3 SUBMITTALS

A. Product Data: For each type and size of sectional overhead door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:

1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
2. Summary of forces and loads on walls and jambs.
3. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.

B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.

C. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.

D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied finishes.

E. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

F. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the sectional overhead door manufacturer for both installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: Engage a firm experienced in manufacturing sectional overhead doors similar to those indicated for this Project and with a record of successful in-service performance.

C. Source Limitations: Obtain sectional overhead doors through one source from a single manufacturer. Obtain accessories from the sectional overhead door manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Amarr Garage Doors.
2. Arm-R-Lite Door Manufacturing Co., Inc.
3. Clopay Building Products Co.
4. Fimble Door Corporation.
5. Haas Door Co.
6. Overhead Door Corporation.
7. Raynor Garage Doors.
8. Wayne-Dalton Corp.
9. Windsor Door; A United Dominion Company.

2.2 ALUMINUM SECTIONS

A. Construct door framing sections with extruded-aluminum shapes, complying with ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, with wall thickness not less than 0.065 inch for door section 1-3/4 inches deep. Fabricate sections with stile and rail dimensions and profiles shown. Join stiles and rails by welding or with concealed, 1/4-inch- minimum-diameter, aluminum or nonmagnetic stainless-steel through bolts, full height of door section. Form meeting rails to provide a weathertight-seal joint. Provide reinforcement for hardware attachment.

B. Fabricate panels of aluminum sheet, complying with ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, not less than 0.050-inch-thick, set in continuous vinyl channel retained with rigid, snap-in, extruded-vinyl moldings or with rubber or neoprene glazing gasket with aluminum stop.

C. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
2. Finish doors with manufacturer's standard powder-coat-applied paint system.

a. Color and Gloss: AF-1.

2.3 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Provide manufacturer's standard, galvanized steel track system, sized for door size and weight, designed for lift type indicated and clearances shown, and complying with ASTM A 653, for minimum G90 zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track at 2 inches o.c. for door-drop safety device. Slope tracks at proper angle from vertical or otherwise design to ensure tight closure at jambs when door unit is closed. Weld or bolt to track supports.

B. Track Reinforcement and Supports: Provide galvanized steel track reinforcement and support members, complying with ASTM A 36 and ASTM A 123. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.

C. Support and attach tracks to opening jambs with continuous angle welded to tracks and attached to wall. Support horizontal (ceiling) tracks with continuous angle welded to track and supported by laterally braced attachments to overhead structural members at curve and end of tracks.

D. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and at top of overhead door.

1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
2. In addition, provide continuous flexible seals at door jambs for a weathertight installation.

E. Full Vision Panels: Manufacturer's standard aluminum tubular frame section fully glazed with 6-mm clear acrylic glazing set in vinyl, rubber, or neoprene glazing channel with removable extruded-vinyl or aluminum stops.

2.4 HARDWARE

A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

B. Hinges: Provide heavy-duty galvanized steel hinges, of not less than 0.0747-inch-thick uncoated steel, at each end stile and at each intermediate stile, per manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges, where required, for doors exceeding 16 feet in width, unless otherwise recommended by door manufacturer.

C. Rollers: Provide heavy-duty rollers, with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch-diameter roller tires for 3-inch track, 2-inch-diameter roller tires for 2-inch track, with case-hardened steel tires.

D. Push/Pull Handles: Provide galvanized steel lifting handles on each side of door.

E. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks, operable from inside only.

2.5 COUNTERBALANCING MECHANISM

A. Torsion Spring: Operation by torsion-spring counterbalance mechanism consisting of adjustable-tension torsion springs, fabricated from oil-tempered-steel wire complying with ASTM A 229, Class II, mounted on a cross-header tube or steel shaft. Connect to door with galvanized aircraft-type lift cables with cable safety factor of at least 5 to 1. Provide springs calibrated for minimum operation – cycle requirements specified.

B. Cable Drums: Provide cast-aluminum or gray-iron casting cable drums grooved to receive cable. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of shaft. Provide 1 additional midpoint bracket for shafts up to 16 feet long and 2 additional brackets at one-third points to support shafts more than 16 feet long, unless closer spacing is recommended by door manufacturer.

C. Cable Safety Device: Include a spring-loaded, steel or bronze cam mounted to bottom door roller assembly on each side, designed to automatically stop door if either cable breaks.

D. Bracket: Provide anchor support bracket, as required to connect stationary end of spring to the wall, to level shaft and prevent sag.

E. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.6 ELECTRIC DOOR OPERATORS

A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operational life specified, complete with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation. Comply with NFPA 70.

B. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging sprocket-chain operator and releasing brake for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level.

1. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
2. Provide safety interlock switch to disengage power supply when door is locked.

C. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

D. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.

E. Door-Operator Type: Unless otherwise recommended by door manufacturer because of door size or opening frequency, provide trolley or drawbar type, with V-belt primary drive, chain and sprocket secondary drive, and quick disconnect-release for manual operation.

F. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction, from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or considering service factor.

1. Type: Polyphase, medium-induction type.
2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
4. Provide totally enclosed, nonventilated or fan-cooled motors, fitted with plugged drain, and controller with NEMA ICS 6, Type 4 enclosure for exterior locations.

G. Remote-Control Station: Provide momentary-contact, 3-button control station with push-button controls labeled "Open," "Close," and "Stop." Locate on interior side adjacent to door.

1. Provide exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.

H. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor able to protect full width of door opening. Activation of sensor immediately stops and reverses downward door travel.

1. Sensor Edge: Provide each motorized door with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

a. Provide electrically actuated automatic bottom bar.
b. Self-Monitoring Type: Provide self-monitoring, 4-wire configured device.

I. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive sectional overhead doors and associated work and conditions under which work will be installed. Do not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the Installer. Starting of work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 INSTALLATION

A. General: Install door, track, and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.

B. Fasten vertical track assembly to framing at not less than 24 inches o.c. Hang horizontal track from structural overhead framing with angle or channel hangers welded and bolt fastened in place. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

D. Adjust belt-driven motors as follows:

1. Use adjustable motor-mounting bases for belt-driven motors.
2. Align pulleys and install belts.
3. Tension belt according to manufacturer's written instructions.

3.3 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
3. Review data in the maintenance manuals. Refer to Division 01 Section "Closeout Procedures."

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 08 4110

INTERIOR GLAZED ALUMINUM PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes interior glazed aluminum partitions and supplementary items necessary to complete their installation.

B. Aluminum entrance doors are specified in other Division 08 Sections.

C. Exterior aluminum-framed wall system is specified in Division 08 Section "Glazed Aluminum Wall System".

1.2 PERFORMANCE REQUIREMENTS

A. Structural Loads: Provide glazed aluminum partition systems capable of withstanding uniform load of 5 lbs per sq. ft. based on testing manufacturer's standard system in assemblies similar to those indicated for this Project.

1. Deflection of framing members normal to wall plane is limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch whichever is less.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

B. Shop Drawings: Show details of fabrication and installation. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of systems, made from 12-inch-lengths of full-size components and showing details of joinery, glazing and anchorage.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating aluminum-framed systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.5 WARRANTY

A. Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Material Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Atlas Architectural Metals, Inc.
2. Kawneer Company, Inc.
3. Tubelite Division of Indal, Inc.
4. United States Aluminum Corp.
5. Vistawall Architectural Products.
6. YKK AP America Inc.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308.
5. Welding Rods and Bare Electrodes: AWS A5.10.

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36.
2. Cold-Rolled Sheet and Strip: ASTM A 1008.
3. Hot-Rolled Sheet and Strip: ASTM A 1011.

C. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

F. Glazing: As specified in Division 08 Section "Glazing."

G. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and seal.

H. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

2.3 FABRICATION

A. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

B. Framing Members: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
6. Fabricate for flush glazing (without projecting stops).
7. Product Standard: Kawneer; Trifab II 450.

a. Face: 1-3/4 inches.
b. Depth: 4-1/2 inches.
c. Glass Location: Center.
d. Drawings Designation: AGP-1.

C. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.

1. Provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

D. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.4 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: AF-1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive glazed aluminum partitions and associated work and conditions under which work will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions.

1. Do not install damaged components.
2. Fit joints to produce hairline joints free of burrs and distortion.
3. Rigidly secure nonmovement joints.
4. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components plumb and true in alignment with established lines and grades, without warp or rack.

D. Install glazing as specified in Division 08 Section "Glazing."

E. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment: Limit offset from true alignment to:

a. Where surfaces abut in line, 1/16 inch.
b. Where surfaces meet at corners, 1/32 inch.

3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

END OF SECTION

SECTION 08 4213

ALUMINUM ENTRANCE DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes aluminum entrance doors and supplementary items necessary to complete their installation.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum entrance doors capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Wind Loads: Provide entrance doors capable of withstanding wind-load design pressures calculated according to requirements of latest adopted Local Building Code and "Building Design Summary".

C. Thermal Movements: Provide entrance doors that accommodate thermal movements of supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Dimensional Tolerances: Provide entrance doors that accommodate dimensional tolerances of framing members and adjacent construction.

1.3 SUBMITTALS

A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work.

1. Include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Samples for Verification: For each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has specialized in installing entrance doors similar to those required for this Project and who is acceptable to manufacturer.

B. Source Limitations: Obtain each type of entrance doors through one source from a single manufacturer.

1.5 WARRANTY

A. Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Material Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Kawneer Company, Inc.
2. United States Aluminum Corp.
3. Vistawall Architectural Products.
4. YKK AP America Inc.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 429.
5. Welding Rods and Bare Electrodes: AWS A5.10.

B. Glass and Glazing: Specified in Division 08 Section "Glazing."

2.3 COMPONENTS

A. Doors: Provide manufacturer's standard 1-3/4-inch-thick glazed doors with minimum 0.125-inch-thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.

1. Glazing Stops and Gaskets: Provide manufacturer's standard square snap-on extruded-aluminum glazing stops and preformed gaskets with nonremovable stops on outside of door.
2. Nominal Face Dimensions:

a. Stiles: 3-1/2 inches.
b. Bottom Rail: 12 inches.
c. Mid Rail: 3-1/2 inches.

3. Product Standard: Kawneer; 350.

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Reinforce members as required to retain fastener threads.
2. Do not use exposed fasteners, except for hardware application.
3. Use countersunk Phillips flat-head machine screws finished to match hardware being fastened.

C. Weather Stripping: Manufacturer's standard replaceable weather stripping as follows:

1. Compression Weather Stripping: Molded neoprene complying with ASTM D 2000 requirements or molded PVC complying with ASTM D 2287 requirements.

2.4 HARDWARE – Refer to "Door Hardware" Section

2.5 FABRICATION

A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.

B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.

C. Prepare components to receive concealed fasteners, anchor and connection devices.

D. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

E. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."

F. Metal Protection: Primer, sealant or tape recommended by manufacturer.

2.6 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

D. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.

1. Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

a. Color and Gloss: AF-1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive aluminum entrance doors and associated work and conditions under which work will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance doors. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

C. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction. Comply with requirements of Division 07 Section "Joint Sealants."

D. Install components plumb and true in alignment with established lines and grades without warp or rack of members.

E. Install doors plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.

1. Install surface-mounted hardware according to hardware manufacturer's written instructions using concealed fasteners to greatest extent possible.
2. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.

F. Install glazing to comply with requirements of Division 08 Section "Glazing," unless otherwise indicated.

G. Erection Tolerances: Install entrance doors to comply with the following maximum tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet.
2. Alignment: Limit offset from true alignment to:

a. Where surfaces abut in line, 1/16 inch.

b. Where surfaces meet at corners, 1/32 inch.

3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

3.3 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure entrance doors are without damage or deterioration at the time of Material Completion.

END OF SECTION

SECTION 08 4400

GLAZED ALUMINUM WALL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes glazed aluminum wall systems and supplementary items necessary to complete their installation.

B. Aluminum entrances are included in other Division 08 Sections.

1.2 SYSTEM DESCRIPTION

A. This is a performance specification and glazed aluminum wall system manufacturer shall be responsible for complete design and engineering required to meet specified performance requirements within physical and aesthetic requirements established.

B. Contents documents establish aesthetic criteria and performance requirements for the wall system. Requirements specified or indicated by details are intended to establish basic dimensions of module and sight lines and profiles of members. Include modifications or additions required to meet specified requirements and maintain the visual design concept.

C. Contract Documents do not necessarily indicate or describe total work required for completion of Work. Furnish and install all items required for complete installation.

D. Dimension and profile adjustments may be made in proposed design in interest of fabrication or erection methods or techniques, weatherability factor, or ability of design to satisfy aesthetic and performance requirements, provided that design intent and intent of Contract Documents are maintained.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide manufacturer's glazed aluminum wall system, adapted to application indicated, that complies with performance requirements specified as demonstrated by testing the manufacturers corresponding systems according to test methods indicated.

1. It is the intent to allow manufacturer to provide a standard system and components to the extent that such system complies with the aesthetic design and performance criteria.

B. Air and Water Infiltration: Design and install the glazed aluminum wall system for permanent resistance to air and water leakage through the system in accordance with the following:

1. Air Infiltration: Air leakage through wall system shall not exceed 0.06 cfm per sq. ft. of fixed wall area when tested in accordance with ASTM E 283 at a minimum static air pressure differential of 6.24 lbf per sq. ft.

2. Water Penetration:

   a. Static Air Pressure: There shall be no evidence of uncontrolled water leakage through the wall system, as defined in AAMA 501, when tested in accordance with ASTM E 331 at a minimum differential pressure of 20 percent of inward design wind load but not less than 12.0 lbf per sq. ft.

C. Structural Performance: Design, engineer, fabricate, and install glazed aluminum wall system, including anchorages, to withstand the effects of a wind load acting inward and outward, normal to the plane of the wall, when tested in accordance with ASTM E 330, with no material and deflection failures or permanent deformation of structural members exceeding 0.2 percent of the span.

1. Meet wind load requirements of applicable Local Building Codes and Design Wind Pressures Schedule on drawings.
2. Structural test pressure shall be equal to 150 percent of the positive and negative design wind pressures.
3. Design wall system to accommodate movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
4. Deflections: Wall system shall be capable of withstanding building movements including wind loading and of performing within the following limitations:

   a. Deflection of framing members perpendicular to the plane of the wall shall not exceed 1/175 of its clear span or 3/4 inch, whichever is less.
   b. Deflection of members parallel to the plane of the wall, when carrying its full dead load, shall not exceed an amount that will reduce glass bite by less than 75 percent of the design dimension and shall not reduce edge clearance between itself and the panel, glass, or other fixed member to less than 1/8 inch.
   c. Deflection of framing members in a direction normal to wall plane is limited to 1/360 of clear span, 3/4 inches maximum, where gypsum board surfaces are subject to bending.
   d. Deflection of framing members overhanging an anchor point is limited to 2 times the length of the cantilevered member, divided by 175.
   e. The center deflection of the window stool trim, when subjected to a 250 pound vertical concentrated load, shall not exceed 1/8 inch.
   f. Design wall system to accommodate 3/8" differential vertical live load movement of the floors.

D. Seismic Loads: Provide glazed aluminum wall system, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of Chapter 16 of 2006 IBC.

E. Thermal Movements: Provide glazed aluminum wall system, including anchorages, capable of withstanding thermal movements resulting from an ambient temperature differential of 120 deg F, and a metal surface temperature range of 180 deg F within the wall framing without causing buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, noise or vibration, and other detrimental effects.

F. Condensation Requirements: Provide glazed aluminum wall system with thermal-break construction that has been tested in accordance with AAMA 1503.1 and certified by the manufacturer to provide a condensation resistance factor (CRF) of not less than 55.

G. Infiltrated and Condensation Water Management: Design system to incorporate provisions for guttering and weeping infiltrated and condensate water out of system to the exterior. Coordinate with other adjacent exterior wall components.

H. Structural-Sealant: Capable of withstanding tensile and shear stresses imposed by glazed aluminum wall systems without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

I. Structural-Sealant Joints:

1. Designed to carry gravity loads of glazing.
2. Designed to produce tensile or shear stress of less than 20 psi (138 kPa).
3. Design reviewed and approved by structural-sealant manufacturer.

J. Dimensional Tolerances: Provide glazed aluminum wall system, including anchorage, that accommodates dimensional tolerances of building frame and other adjacent construction.

1.4 SUBMITTALS

A. Product data: Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Prepared by manufacturer, not fabricator. Show adaptation of manufacturer's standard glazed aluminum wall system to the project; include typical unit elevations at 1/2-inch scale and details at full scale. Show dimensions, profiles of members, anchorage system, interface with building construction, and glazing.

1. Include setting drawings, templates, and directions for the installation of anchor bolts and other anchorages installed as a unit of work under other sections.
2. Indicate where and how the system deviates from Contract Documents.
3. Shop drawings shall contain seal of a professional engineer currently registered in licensing jurisdiction of the project and a written statement that the wall system conforms to project requirements, applicable codes, and specified conditions.
4. Provide for information only, material properties and other information needed for structural analysis including computations, prepared, signed, or, and sealed by a professional engineer licensed to practice in the jurisdiction where the project is located.
5. Submittal shall contain statement explaining how proposed system design will accommodate infiltrated and condensate water.

C. Samples: Provide pairs of samples of each aluminum finish type and color on 12-inch-long sections of extrusions or formed shapes and on 6-inch-squares of aluminum sheet or plate. Include 2 or more units in each sample set showing the extreme limits of variations expected in color and texture of finish.

D. Sample Mock-Up: Provide 24 inch by 24 inch sample mock-up of typical horizontal and vertical mullion intersection with glazing condition. Include sample mock-up of any unusual condition.

E. Manufacturer's Project Acceptance Document: Submit certification that manufacturer and installer will warrant glazed aluminum wall system for the specific site, design, details and application indicated for this Project.

1. Submit sample copy of Manufacturer's Extended Warranty.

F. Test Reports for Structural-Sealant: Compatibility and adhesion test reports from sealant manufacturer indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with sealants; include sealant manufacturer's interpretation of test results for sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

G. Quality-Control Program for Structural-Sealant: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.

H. Manufacturer's Field Reports: Submit detailed report of visits made by representatives of the manufacturer to the Project as specified in "Field Quality Control" Article.

I. Design Engineer Design Certification: Submit certification stating that the design of all components, including connection to the supporting structure, is in compliance with all provisions of the Contract Documents and the local building code.

J. Design Engineer Inspection Certification: Submit as specified in the "Field Quality Control" Article.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform glazed aluminum wall work who has a minimum of 5 years specialized experience in installing glazed aluminum wall systems similar to that required for this Project and who is acceptable to manufacturer of wall system.

1. Installer Certification: Submit written certification from manufacturer of glazed aluminum wall system certifying that Installer is approved by manufacturer to install specified system.
2. Installer's Field Supervision: Require Installer to maintain a full-time supervisor/foreman who is on job site during times that glazed aluminum wall system work is in progress and who is experienced in installing systems similar to type and scope required for this Project.

B. Design Engineer Qualifications: Professional engineer legally authorized to practice in the jurisdiction where the Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of glazed aluminum wall systems similar to this Project in material, design, and extent, and, that has a record of successful in-service performance.

C. Single-Source Responsibility: Provide glazed aluminum wall system for the project from one source from a single manufacturer.

D. Structural-Sealant Glazing: Comply with ASTM C 1401 "Guide for Structural Sealant Glazing" for design and installation of glazed aluminum wall systems utilizing structural-sealant glazing.

1. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

E. Field-Constructed Mock-Up: Prior to installing aluminum wall system, construct a full-size sample mock-up, including mullions, panels, vision glass, and other elements of the system, to verify selections made under sample submittals and to represent completed system for aesthetic effects and qualities of materials and installation. Build the mock-up to comply with following requirements, using materials indicated for the final installation.

1. Construct the mock-up on site in the location and sizes indicated or, if not indicated, as directed by the Architect.
2. Demonstrate the proposed range of aesthetic effects and workmanship.
3. Obtain the Architect's acceptance of the mock-up before starting final erection of the glazed aluminum wall system.

4. Maintain the mock-up in undisturbed condition during construction as a standard for judging completed wall installation.
5. When directed, demolish and remove mock-up from the site unless accepted by the Architect, to be incorporated into the Work.

F. Product Options: The drawings indicate size, profiles, and dimensional requirements of the glazed aluminum wall system and are based on the specific type and model indicated. Glazed aluminum wall systems by other manufacturers having equal performance characteristics may be considered provided deviations in dimensions and profiles are minor and do not change the intended aesthetic effects or intended performance requirements as judged by the Architect.

G. Preinstallation Conference: Before beginning wall installation, conduct a preinstallation conference at the Project site with the wall system manufacturer, installer, and other interested parties to review procedures, schedules, and coordination of the wall installation with other elements of the Work.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabrication without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

A. General: Submit written warranty signed by authorized representatives of the wall system manufacturer and installer warranting that wall system is free from defects in material and workmanship, and in conformance with the requirements of the Contract Documents and agreeing to repair or replace defective Work during a 3-year period following date of Material Completion.

1. Defects are defined to include but not limited to the following:

a. Failure of system to accommodate building movement.
b. Through water leakage.
c. Failure of operating components to function normally.
d. Deterioration of metals beyond normal weathering.
e. Failure of the system to meet performance requirements.
f. Failure of system to manage infiltrated or condensation water.
g. Noise or vibration caused by structural or thermal movements.
h. Glazing breakage.

B. Finish Warranty: Provide written warranty signed by manufacturer and installer, agreeing to repair or replace work which exhibits defects in finish. "Defects" is defined to include, but is not limited to, peeling, chipping, chalking, fading, abnormal aging or deterioration, and failure to perform as required for following warranty period.

1. Fluoropolymer Finish: 20 years from date of application for color and film integrity.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. EFCO Corporation
2. Kawneer Company, Inc.
3. United States Aluminum Corp.
4. Vistawall Architectural Products.
5. YKK AP America Inc.

2.2 PRODUCT STANDARD

A. The design for glazed aluminum wall system is based on the following manufacturer's system. Subject to compliance with requirements, provide named product or a comparable product by one of the acceptable manufacturers.

1. Curtainwall: Kawneer; 1600 Wall System 1 and 2.
2. Depth: 6 inches and 7-1/2 inches, as indicated.
3. Mullions: Captured and structural silicone glazed, as indicated.

2.3 MATERIALS

A. Aluminum: Provide alloy, temper, and thickness recommended by the manufacturer for the type of use and finish indicated and with not less than the strength and durability properties required to fulfill performance requirements.

1. Extruded Bars, Tubes and Shapes: Comply with requirements of ASTM B 221.
2. Plate and Sheet: Comply with requirements of ASTM B 209.

B. Glass: Provide glass of types and thicknesses indicated. Fabricate glass to sizes required for openings indicated with edge clearances and tolerances complying with manufacturer's recommendations. Refer to Division 08 Section "Glazing" for requirements.

C. Glazing Gaskets: Manufacturer's standard sealed-corner pressure- glazing or wedge-lock dry glazing system. Refer to Division 08 Section "Glazing" for requirements.

D. Glazing Sealants: As recommended by manufacturer for joint type.

1. Structural-Sealant: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural-sealant and approved by structural-sealant manufacturer for use in glazed aluminum wall assembly indicated.

a. Minimum Tensile Strength: 100 psi (690 kPa).
b. Modulus of Elasticity: As required by structural-sealant-glazed aluminum wall system design to meet performance requirements.
c. Color: Black, unless otherwise indicated.

2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, neutral-curing silicone formulation compatible with system components with which it comes in contact; and recommended by weatherseal-sealant and curtain-wall manufacturers for this use.

   a. Joint Movement Capability: Accommodates a 50 percent increase or decrease in joint width at time of application when measured according to ASTM C 719.
   b. Color: Black, unless otherwise indicated.

3. Bond-Breaker Tape: Manufacturer's standard tetrafluoroethylene-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Concealed Metal Joint Sealant: Curtain wall type, nondrying, nonskinning, AAMA 809.2.

F. Exposed Sealants and joint fillers, for joints at the interface of wall construction and other work, shall comply with requirements specified in Division 07 Section "Joint Sealants".

G. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36.
2. Cold-Rolled Sheet and Strip: ASTM A 611.
3. Hot-Rolled Sheet and Strip: ASTM A 570.

H. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

I. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads.
4. Finish exposed portions to match framing system.
5. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended by manufacturer.

J. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

K. Concealed Flashing: Dead-soft, 0.018-inch-thick stainless steel, ASTM A 240 of type recommended by manufacturer.

L. Thermal Insulating Materials: Specified in Division 07 Section "Thermal Insulation."

M. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.4 FABRICATION

A. General: Fabricate glazed aluminum wall system at the manufacturer's shop to the fullest extent possible and before applying finishes. Provide concealed fasteners. Make provisions to drain to exterior face of wall, water entering at joints and condensation occurring within wall construction including secondary water. Provide horizontal members with continuous gutters to drain moisture to exterior through protected weep holes.

1. Match exposed work to produce continuity of line. Fit joints accurately and secure rigidly.
2. Seal joints and connections in exterior metal watertight with metal joint sealant.
3. Provide properly designed watertight expansion joints as required.
4. Design and anchor wall system so that it will not be distorted nor the fastenings seriously stressed from the expansion and contraction of the metal. Provide slotted holes for erection adjustment.
5. Welding shall conform to the requirements of the Standard Code for Arc and Gas Welding of the American Welding Society.
6. Welds shall be of adequate strength and durability, with jointing tight, flush, smooth and clean.
7. Weld behind finished surfaces so as to cause no distortion and/or discoloration on the finished side.
8. Remove weld splatter and welding oxides on finished surfaces.
9. Provisions for field replacement of glazing. Provide minimum clearances and depth of glazing packets as recommended by glass manufacturer for thickness and type of glass indicated.

    a. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural-sealant cures.

2.5 FINISHES

A. General: Comply with the NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

D. High-Performance Organic Coating: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.

1. Fluorocarbon 2-Coat Coating System: Manufacturer's standard 2- coat thermocured system, complying with AAMA 2605, composed of specially formulated inhibitive primer and fluorocarbon color topcoat containing not less than 70 percent polyvinyldene fluoride resin by weight.

    a. Color and Gloss: AF-1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates surfaces to receive glazed aluminum wall system and associated work and conditions under which work will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to Installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 PREPARATION

A. Furnish inserts for setting in concrete forming, and similar work required to support glazed aluminum wall system.

B. Field measure and verify governing dimensions, including floor elevations, floor-to-floor heights, minimum clearance between wall system and structural frames and other permissible dimensional tolerances in building frame.

C. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.3 INSTALLATION

A. Comply with manufacturer's instructions for installing fabricated wall components, with particular care and attention to preservation of applied finishes. Discard or remove and replace damaged members.

B. Fit joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight, unless otherwise indicated. Provide means to drain water to the exterior to produce a permanently weatherproof system.

C. Install components to drain water passing joints, condensation occurring in glazing channels, condensation occurring within framing members, and moisture migrating within the system to the exterior.

D. Do not cut, trim, weld or braze component parts during erection, in any manner which would damage finish, decrease strength or result in visual imperfection or failure in performance of construction.

E. Secure to structure with non-staining and non-corrosive shims, anchors, fasteners, spacers and fillers.

F. Maintain minimum clearance of one inch between inside face of wall system and outside face of building structure. Allow 3/8 inch minimum for sealant between wall system and adjacent construction.

G. Anchor components securely in place. Shim and allow for movement resulting from changes in thermal conditions. Provide separators and isolators to prevent corrosion, electrolytic deterioration, and impede movement of moving joints.

H. Glazing: Install glass and glazing material in accordance with manufacturers, recommendations and as specified. Comply with requirements specified in Division 08 Section "Glazing".

1. Structural-Sealant Glazing:

a. Prepare surfaces that will contact structural-sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion.
b. Preparation includes, but is not limited to, cleaning and priming surfaces.

I. Sealants and Joint Fillers: Seal perimeter of glazed aluminum wall system. Comply with requirements specified in Division 07 Section "Joint Sealants".

J. Erection Tolerances: Install components plumb, level, accurately aligned, and located in reference to column lines and floor levels. Adjust work to conform to the tolerances indicated below. Tolerances indicated below are maximum and are not cumulative.

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
c. Where surfaces are separated by reveal or protruding element of 1 inch wide or greater, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane or location shown to 1/8 inch in 12 feet or 1/2 inch in any total length.

3.4 FIELD QUALITY CONTROL TESTS

A. Test installed glazed aluminum wall system in accordance with AAMA 501.2, "Specifications for Field Check of Metal Curtainwalls for Water Leakage."

1. After lower two typical floors of the wall system is completed, perform test at location designated by the Architect. Perform additional test on top two typical floors.
2. Satisfactory results of the check do not relieve the Contractor from conforming to requirements of the approved shop drawings and job specifications.
3. Remedial measures found necessary and effective in eliminating leakage in the area checked shall be used in fabricating and installing the remainder of the wall on the building.

B. Design Engineer Inspection: Design engineer, responsible for the structural aspects of the system shall inspect the completed installation for compliance with the design and direct installer to correct any portion that is not in compliance. Upon resolution of all installation deficiencies, design engineer shall certify that installation is in compliance with the design.

C. Manufacturer's Field Service: Manufacturer's representative shall periodically inspect material and installation to insure installation is proceeding in accordance with manufacturer's recommendations and warranty requirements. Representative shall submit a written report of each visit indicating observations, findings and conclusions of inspection.

END OF SECTION

SECTION 08 7100

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes items known commercially as finish or door hardware that are required for swing, sliding and folding doors, except special unique hardware specified in same section as doors and frames on which they are installed; and supplementary items necessary to complete work required for their installation.

B. Coordinate electrical connections for hardware items requiring electrical and control wiring with Division 16.

1.2 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product Data: Submit manufacturer's technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to evidence compliance with these specifications.

C. Final Hardware Schedule:

1. Submit 6 copies of final hardware schedule for approval before fabrication or delivery of hardware to Site.
2. Include details as to proper type strike plates, length of spindle, hand, backset and bevel of locks, hand and degree opening for closers, length of kick plates, length of rods for flush bolts, type of door stop and other functions of mechanisms.
3. Include complete wiring diagrams for each opening requiring electrified hardware. Provide a copy with each hardware schedule submitted for approval. Supply a copy with delivery of hardware to jobsite and another copy to owner at time of job completion. All electrical components to be listed by opening in the hardware submittals.
4. Include complete operational description of electronic components listed by opening in the hardware submittals. Operational descriptions to detail how each electrical component functions within the opening incorporating all conditions of ingress and egress. Provide a copy with each hardware schedule submittal for approval. Supply a copy with delivery of hardware to jobsite and another copy to owner at time of job completion.
5. Include elevation drawings of electronic hardware and systems identifying locations of the system components with respect to their placement in the door opening. Provide a copy with each hardware schedule submitted for approval. Supply a copy with delivery of hardware to jobsite and another copy to owner at time of job completion.
6. Coordinate final hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

7. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include following information:

   a. Type, style, function, size, and finish of each hardware item.
   b. Name, manufacturer and picture of each item.
   c. Fastenings and other pertinent information.
   d. Location of each hardware set cross referenced to the room name and number in which the door serves.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for hardware.
   g. Door and frame sizes and materials.

8. Submittal Sequence: Submit final schedule at earliest possible date, particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in Project construction schedule. Include with schedule product data, samples, shop drawings of other work affected by door hardware, and other information essential to coordinated review of schedule.
9. Keying Schedule: Submit separate detailed schedule indicating clearly how Owner's final instructions on lock functions and keying have been fulfilled.

D. Samples:

1. Submit samples, if requested, of each type of exposed hardware unit in finish indicated and tagged with full description for coordination with schedule. Submit samples prior to submission of final hardware schedule.
2. Samples will be returned to supplier. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated in Work, within limitations of keying coordination requirements.

E. Templates:

1. Furnish necessary templates and template data to manufacturers of items that will be fitted with finish hardware in ample time to avoid delay in work.
2. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Obtain each type of hardware (latch and lock sets, hinges, closers) from single manufacturer, although several may be indicated as offering products complying with requirements.

B. Supplier Qualifications:

1. Recognized architectural door hardware supplier, with warehousing facilities in Project's vicinity, that has record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during course of Work, for consultation.
2. Supplier to meet with Owner to finalize lock functions and keying requirements and to obtain final instructions in writing.
3. All products are to be furnished by an authorized Distributor to ensure quality compliance, service and warranty of products.

4. Finish Hardware, Security Hardware and Automatic Operators to be installed by a Factory Authorized Distributor. The Distributor to employ and use factory trained and certified hardware, auto operator and security system installers.
5. Furnish complete wiring diagrams, riser diagrams, elevation drawings and operational descriptions of electrical components and systems, listed by opening in the hardware submittals. Elevation drawings identify locations of the system components with respect the their placement in the door opening. Operational descriptions fully detail how each electrical component will function within the opening, including all conditions of ingress and egress. Provide a copy with each hardware schedule submitted for approval. Supply a copy with delivery of hardware to the jobsite and another copy to the Owner at the time of project completion.

C. Regulatory Requirements:

1. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by UL, Warnock Hersey, FM, or other testing and inspecting organization acceptable to authorities having jurisdiction for use on types and sizes of doors indicated in compliance with requirements of fire-rated door and door frame labels.
2. Handicap: Provide door hardware that complies with applicable requirements of Americans with Disabilities Act (ADA), ANSI A117.1 and State Handicap Laws.

1.4 DELIVERY, STORAGE AND HANDLING

A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.

C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).

E. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of Work will not be delayed by hardware losses both before and after installation.

1.5 MAINTENANCE

A. Maintenance Tools and Instructions: Furnish complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of finish hardware.

1.6 WARRANTY

A. Special Warranties:
1. Door Closers – Ten year period.
2. Electrified Exit Devices – One year period.
3. Non-electrified Exit Devices – Three year period.
4. Locks and Cylinder – Five year period.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specific product, material or manufacturer listed under each item below is "acceptable" only if manufacturer can evidence product compliance with requirements of Contract Documents.

B. Manufacturers used in the hardware sets are indicated with an asterisk (*).

C. For manufacturers not listed, submit as substitution according to the Conditions of the Contract and Division 01 Specification Sections.

2.2 MATERIALS AND FABRICATION

A. Manufacturer's Name Plate:

1. Do not use manufacturer's products which have manufacturer's name or trade name displayed in visible location (omit removable nameplates), except in conjunction with required fire or exit rating labels.
2. Manufacturer's identification will be permitted on rim of lock cylinders only.

B. Base Metals:

1. Produce hardware units of base metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI A156 series standard for each type hardware item and with traditional U.S. finishes for finish designations indicated.
2. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.

C. Fasteners:

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.
3. Furnish screws for installation, with each hardware item.
4. Provide Phillips flat-head screws except as otherwise indicated.
5. Finish exposed screws to match hardware finish or, if exposed in surfaces of other work, to match finish of other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
6. Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners.
7. Do not use thru-bolts for installation of all exit devices, door closers and overhead stops/holders. Doors are to have special blocking. See wood and hollow metal section. Provide wood screws for wood doors to attach closers, exit devices and overhead stops.

2.3 HINGES, BUTTS AND PIVOTS

A. Butt Hinges:

1. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

2. Screws: Provide Phillips flat-head screws complying with following requirements:

   a. For metal doors and frames install machine screws into drilled and tapped holes.
   b. For wood doors and frames install wood screws.
   c. For fire-rated wood doors install #12 x 1-1/4-inch, threaded-to-head steel wood screws.
   d. Finish screw heads to match surface of hinges or pivots.

3. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

   a. Out-Swing Exterior Doors: Non-removable pins or Safety stud.
   b. Out-Swing Corridor Doors with Locks: Non-removable pins or Safety stud.
   c. Interior Doors: Non-rising pins.
   d. Tips: Flat button and matching plug, finished to match leaves, except where hospital tip (HT) indicated.

4. Full mortise hinges to have hole in bottom tip for easy pin removal.
5. Where not otherwise scheduled, required size of butt hinges for 1-3/4 inch thick doors:

   a. Butt Hinges Required per Door:

      1) Doors 60 inches or less in height: 2 butt hinges.
      2) Doors over 60 inches and not over 90 inches (86 inches for fire-rated doors): 3 butt hinges.
      3) Doors over 90 inches and not over 120 inches (116 inches for fire-rated doors): 4 butt hinges.

   b. Interior Doors:

      1) Doors up to 3'-0" in width: Standard weight, ball bearing, 4-1/2 x 4-1/2, unless otherwise noted.
      2) Doors over 3'-1" in width and labeled doors over 8'0" in height: Heavy weight, ball bearing, 5 x 4 -1/2.

   c. Electric Hinges: Provide concealed circuit electric hinge for one hinge at doors scheduled to receive door mounted type electric locks, electric door closers, or other electrical devices which require power through door.
   d. Acceptable manufacturers:

      1) Ives*
      2) Bommer
      3) McKinney

B. Continuous Hinges:

1. Full mortised and non-handed, stainless steel.
2. U.L. listed for Class A hollow metal fire doors and 20 minute wood fire doors.
3. Acceptable manufacturers:

   a. Ives*
   b. Select
   c. Markar

2.4 LOCK CYLINDERS AND KEYING

A. Keying:

1. Comply with Owner's instructions for master keying and, except as otherwise indicated, provide individual change keys for each lock that is not keyed alike with a group of related locks.

B. Cylinders:

1. Review the keying system with the Owner and provide the type required (master, grandmaster, or great grandmaster).
2. Unless otherwise indicated, equip locks with Best interchangeable core cylinders with temporary keyed cores, featuring patented, restricted keyway.
3. Metals: Construct lock cylinder parts from brass and bronze, stainless steel, or nickel silver.
4. Furnish final cores and keys for installation by contractor and Owner.

C. Keys:

1. Permanently inscribe each key with number of lock that identifies cylinder manufacturer's key symbol, and notation, "DO NOT DUPLICATE." All cylinders to be stamped with keyset in a concealed location (CKC).
2. Provide temporary construction cores.
3. Key Material: Provide keys of nickel silver only.
4. Key Quantity:

    a. 4 change keys for each cylinder.
    b. 8 master keys for each master system.
    c. 8 grandmaster keys for each grandmaster system.
    d. 12 construction master keys.
    e. 2construction core control keys.
    f. 2 permanent core control keys.

5. Deliver permanent keys and permanent cores via registered mail to Owner's representative.
6. Deliver construction master keys and construction control keys to General Contractor's jobsite representative with temporary cores. Contractor to coordinate installation of permanent cores with Owner.

2.5 KEY CONTROL SYSTEM AND SOFTWARE

A. Provide a key control system including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150 percent of the number of locks required for the Project.

1. Provide complete cross index system set up by key control manufacturer, and place keys on markers and hooks in the cabinet as determined by the final key schedule.
2. Provide Telkee AWC-150-S X P84 Core Storage Panel.

B. Deliver key cabinet, punch machine and software to Owner's representative.

2.6 LOCKS, LATCHES AND BOLTS

A. Locksets - Mortise Type - Lever Handle:

1. General:

a. Chassis: cold-rolled steel, handing field-changeable without disassembly.
b. Latchbolts: 3/4-inch throw stainless steel anti-friction type.
c. Lever Trim: through-bolted, accessible design, cast or solid rod lever as scheduled. Spindles: independent break-away.
d. Thumbturns: accessible design not requiring pinching or twisting motions to operate.
e. Deadbolts: stainless steel 1-inch throw.
f. Electric operation: Manufacturer-installed continuous duty solenoid.
g. Strikes: 16 gage curved stainless steel, bronze or brass with 1" deep box construction, lips of sufficient length to clear trim and protect clothing.
h. Scheduled Lock Series and Design: Schlage L series, 17A design.
i. Certifications:

1) ANSI A156.13, 1994, Grade 1 Operational, Grade 1 Security.
2) ANSI/ASTM F476-84 Grade 30 UL Listed.

2. Knurling: Provide tactile warning on outside trim of locksets at electrical closets, mechanical and elevator equipment rooms.
3. Acceptable manufacturers:

a. Schlage*
b. Best
c. Falcon

B. Flush Bolts:

1. ANSI/DHI A115.16.
2. 1/2 inch round rods, forged brass or bronze, furnished in pairs, (top and bottom of door); lengths of rod 12 inches; where door is higher than 7'-0", top bolt to be of sufficient length to locate flush bolt operator 6'-0" above finish floor.
3. Provide standard top strike and dustproof bottom strike.
4. Provide rounded faces where required by door construction.
5. Acceptable manufacturers:

a. Ives*
b. Rockwood
c. Burns

C. Exit/Panic Devices:

1. Touch bar type.
2. Provide rim type devices on single doors only.
3. Provide outside trim as required and as scheduled. All levers to match lockset levers.
4. Panic devices to be listed under "Panic Hardware" in Accident Equipment List of Underwriters' Laboratories.
5. For "Fire Doors", including 20 min. doors, provide panic devices with UL "Fire Exit Hardware" label.
6. Except on fire-rated doors where closers are provided on doors equipped with exit devices, equip units with keyed dogging device to keep latch bolt retracted, when engaged.
7. Except at doors with thresholds, provide vertical rod devices which hold rods in retracted position when door is open.

8. Knurling: Provide tactile warning on outside trim of exit devices at electrical closets, and mechanical and elevator equipment rooms.
9. Acceptable manufacturers and model:

    a. Von Duprin*

2.7 PUSH/PULL UNITS

A. Exposed Fasteners: Provide manufacturer's standard exposed fasteners for installation, thru-bolted for matched pairs but not for single units.

B. Acceptable manufacturers:

1. Ives*
2. Rockwood
3. Burns

2.8 AUTOMATIC OPERATORS

A. Operation: Push button, push plate, switch-activated, manual or field-programmable manual/electric power assisted Push 'N' Go opening with Power Boost closing and holding.

1. Close door against stop after each cycle and hold against drafts, winds and stack pressure.
2. Cycle Testing: 10 Million automated cycles.
3. Reduced Manual Opening Force: 11 lb-force (50 N) maximum.
4. Closing Force: 9 lb-force (26.6 N).
5. Auto Reverse Open: The door will stop and reverse if an object is encountered during the opening cycle.
6. Service Conditions: Satisfactory operation between -30 deg F (-34 deg C) and 160 deg F (72 deg C).

B. Characteristics:

1. All electromechanically powered operators to include the following features or functions:

    a. Control box and motor/gear box contained in aluminum housing.
    b. Motor: 1/12 hp DC permanent magnet motor with shielded ball bearings stops when door stops or is fully open and when breakaway is operated.
    c. Precision machined gears and bearing seats and all-weather lubricant mounted on vibration isolators. No exposed gears.
    d. Provide header section which will be extruded enclosure concealing all operating parts except arms and manual control switches. Coordinate header section with aluminum frame supplier. Header to be painted to match other framing materials. Supplier to coordinate with frame supplier to have header section factory painted with balance of aluminum door frames.
    e. Manual "Off/Auto/Hold-Open" Switch.
    f. Factory set door hold-open voltage.
    g. On-board 1.0 amp (24VAC) power supply for electric strikes and accessories.
    h. Dedicated and clearly labeled accessory connectors.
    i. Fail-safe Operation: In the event of a power failure, the door will operate manually with controlled spring closing without damage to operator components.
    j. Power Boost Disable Option: Power boost will shut off when activate signal is received and the power boost cycle has been initiated.

k. Adjustment by digital interface via keypad input in self-contained housing for:

1) Opening Speed.
2) Backcheck Speed.
3) Push 'N' Go.
4) Hold-open - settings from 2 to 32 seconds.
5) Auto Reverse closing force.
6) Delayed activation - provides 1 second delay between reception of the activation signal and opening of the door.
7) Adjustable latching force - 0 to 23 degrees from fully closed position.
8) Alternate Action single activation to keep door open until second activation occurs.
9) Electric Lock Relay - Fail Safe (SA), Fail Secure (SE), or Off.
10) Adjustable Backcheck position in increments of 5 degrees from 45 - 80 degrees of opening.
11) Logic Terminal for interface with accessories, mats, and sensors.
12) Safety Slow/Stop.
13) Power Boost - latching feature, which applies an additional 25 pounds closing force.
14) Door Operating Arm: Forged Steel, attached at natural pivot point.
15) Exposed Arm: Surface push/pull arm, cast and machined, factory painted and finished to match operator enclosure.
16) Control circuits for actuators and safeties: Low-voltage, NEC Class II.
17) Power Supply required: 115 VAC (15 am circuit breaker, one per unit.

l. Door Operating Arm: Forged Steel, attached at natural pivot point.
m. Exposed Arm: Surface push/pull arm, cast and machined, factory painted and finished to match operator enclosure.
n. Control circuits for actuators and safeties: Low-voltage, NEC Class II.
o. Power Supply required: 115 VAC (15 am circuit breaker, one per unit.

C. Unless otherwise indicated, actuator plates to have a stainless steel touch plate that measures 4-inch-square with "Push To Operate" in high visibility lettering. The actuator plate to be weather resistant, designed to mount in a bollard or frame as scheduled and provide normally open momentary contacts.

D. Installation of the automatic door operators to be performed by a factory trained and factory certified installer skilled in the installation of automatic door operators and equipment. All low voltage switch hookups are the responsibility of the operator installer, as well as temporary wiring hookup to plug into wall outlet for test of system. Final hookup of 115VAC power to be handled by and coordinated with the General Contractor's electrical contractor.

E. The Contractor to furnish a certificate executed by a representative of the manufacturer of the automatic operators certifying that all operators have been installed in accordance with the manufacturer's instructions, have been inspected and adjusted, and are operating as designed.

F. Acceptable manufacturers:

1. Horton
2. LCN*
3. Record

2.9 CLOSERS AND DOOR CONTROL DEVICES

A. Size of Units: Except as otherwise specifically indicated, comply with manufacturer's recommendations for size of door control unit depending on size of door, exposure to weather, and anticipated frequency of use. All closers to be field adjusted for proper operation.

B. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ADA and ANSI A117.1 provisions for door opening force and delayed action closing.

C. Overhead Closers:

1. Where sized closers are used, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather and anticipated frequency of use.
2. Regular or parallel arms as required by mounting, full rack and pinion, independent speed and latching regulating valves, adjustable back-check feature, 180 deg. door opening where construction permits, adjustable spring power for exterior doors.
3. Where closers with built in positive stops are used, provide one piece stops of cast malleable iron material with built in springs. Where required, the hold open assembly handle for the stop is to rotate on ball bearings. All parallel arm mounted closers are to have heavy duty EDA type arms.
4. Mount closer on room side of door unless otherwise indicated.
5. Provide reduced spring power closers on non-fire rated interior doors to meet handicap requirements (5 lbf) and as approved by Local authority for fire rated doors.
6. Provide all drop plates, shoe supports, special templates, etc. required to properly mount closers according to manufacturer's recommendations.
7. Acceptable manufacturers:

    a. LCN* 4011/4111 Series
    b. Sargent 281 Series
    c. Corbin-Russwin DC8000 Series

D. Door Stops:

1. Wall Bumpers:

    a. Wrought or die cast brass, bronze or stainless steel with gray convex replaceable rubber.
    b. Anchors:

        1) Masonry or concrete: Machine screw and expansion shield.
        2) Wood blocking: Wood screw.

    c. Acceptable manufacturers:

        1) Ives*
        2) Rockwood
        3) Burns

2. Floor Stops:

    a. Heavy duty cast (not die cast or wrought) brass, bronze or aluminum with gray replaceable rubber.
    b. Anchors: Machine screw and expansion shield.

c. Acceptable manufacturers:

1) Ives*
2) Rockwood
3) Burns

3. Overhead Stops and Holders:

a. Acceptable manufacturers:

1) Glynn Johnson*
2) Rixson
3) ABH

E. Door Silencers:

1. Metal Frames: Gray rubber.
2. Wood Frames: BHMA L03011.
3. Furnish 3 for each single door; 2 for each pair of doors.
4. Omit silencers where perimeter gasketing is scheduled.

F. Electromagnetic Door Holders:

1. Provide transformers and wiring necessary to install and connect to building electrical and fire alarm system.
2. Acceptable manufacturers:

a. LCN*
b. Rixson
c. ABH

2.10 DOOR TRIM UNITS

A. Kick, Mop and Armor Plates: (Protection Plates)

1. Kick Plate Height: 8 inches.
2. Mop Plate Height: 6 inches.
3. Armor Plate Height: 36 inches.
4. Plates Thickness:

a. Stainless Steel: .050 inch, 3BE.

5. Where protection plates occur more than 16 in. (406mm) above bottom of fire doors, the plates must be labeled.
6. Length of kick plates and mop plates: Nominal width of door less 1-1/2 inch on push side and nominal width of door less 1/2 inch on pull side.
7. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws. All screw heads are to be countersunk type.
8. Acceptable manufacturers:

a. Ives*
b. Rockwood
c. Burns

2.11 WEATHERSTRIPPING AND SEALS:

A. General: Provide continuous weatherstripping on exterior doors and smoke, light, sound or automatic seals on interior doors where indicated or scheduled. Provide non-corrosive fasteners for exterior applications and elsewhere as indicated.

B. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.

C. Acceptable manufacturers:

1. National Guard Products*
2. Reese Enterprises
3. Zero International

2.12 HARDWARE FINISHES

A. Match items to the manufacturer's standard color and texture finish for the latch and lock sets.

B. Provide finishes that match those established by BHMA or, if none established, match the Architect's sample.

C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

D. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze, and aluminum, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer."

E. The designations used in schedules and elsewhere to indicate hardware finishes are the industry-recognized standard commercial finishes, except as otherwise noted.

1. Rust-Resistant Finish: For iron and steel base metal required for exterior work and in areas shown as "High Humidity" areas (and also when designed with the suffix -RR), provide 0.2-mil-thick copper coating on base metal before applying brass, bronze, nickel, or chromium plated finishes.

F. Continuous Geared Hinges: Clear Aluminum.

G. Hinges: 652 - Satin Chrome Plated Steel.

H. Hinges: 630 - Satin Stainless Steel.

I. Locksets, Latchsets: US32D - Satin Stainless Steel.

J. Exit Devices: US26D - Satin Chrome Plated.

K. Push/Pull Bars, Push and Pull Plates: US32D - Satin Stainless Steel.

L. Closers: Powder Coat Aluminum.

M. Wall Bumpers, Overhead Stops/Holders: US32D - Satin Stainless Steel.

N. Floor Stops, Flush Bolts: US26D - Satin Chrome.

O. Protection Plates: US32D - Satin Stainless Steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine and verify that receiving substrate surfaces of structure have no defects or errors which would result in poor or potentially defective application or cause latent defects in workmanship.

B. Starting installation will imply acceptance of surfaces.

3.2 INSTALLATION

A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.

1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by Door and Hardware Institute.
2. "Recommended Locations for Builders Hardware for Custom Steel Doors and Frames" by Door and Hardware Institute.
3. NWWDA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors."

B. Install each hardware item in compliance with manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

C. Prior to installation of electronic hardware, arrange conference between supplier, installers and related trades to review materials, procedures and coordination of related work.

D. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

F. Weatherstripping and Seals:

1. Comply with manufacturer's instructions and recommendations to extent installation requirements are not otherwise indicated.
2. Set interior of thresholds in full bed of sealant and secure with brass screws in expansion shields spaced not over 12 inches on centers. Extend thresholds full width of opening and notch at door stops.
3. Attach weatherstrip to head and jambs of hollow metal door frames with oval-head bronze or brass sheet metal screws spaced not over 1-1/2 inch on centers. Miter weatherstripping at corners.
4. Attach rain-drip to head of hollow metal door frames with oval-head bronze or brass sheet metal screws spaced not over 6 inches on centers. Extend raindrip full width of frame.
5. Install automatic door bottoms to mortised (surface at fire rated doors) sill of doors.

6. Install adjustable door stops to head and jambs of door frame with self-tapping screws spaced at 12 inches on center. Adjust neoprene contact strip to provide uniform seal with door.

G. Furnish and install low voltage wiring from door hardware to security junction box above door.

3.3 ADJUSTING, CLEANING, AND DEMONSTRATING

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for application made.

B. All door closers to be inspected after installation by a factory representative to ensure proper adjustment and operation. A report to be filed with the Architect after said visit has been completed. Contractor to readjust all closers as required.

C. Wherever hardware installation is made more than one month prior to acceptance or occupancy of space or area, return to work during week prior to acceptance or occupancy, and make final check and adjustment of hardware items. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

D. Clean adjacent surfaces soiled by hardware installation.

E. Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finishes, during final adjustment of hardware.

F. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer, accompanied by representatives of manufacturers of latchsets and locksets and of door control devices, and of other major hardware suppliers, are to return to Project to perform following work:

1. Installer to examine and re-adjust each item of door hardware as necessary to restore function of doors and hardware to comply with specified requirements.
2. Consult with and instruct Owner's personnel in recommended additions to maintenance procedures.
3. Replace hardware items that have deteriorated or failed due to faculty design, materials, or installation of hardware units.
4. Prepare written report of current and predictable problems (of substantial nature) in performance of hardware.

3.4 SCHEDULE OF DOOR SILENCERS

A. Provide door silencers for interior door frames (except for frames for fire rated, lightproof and soundproof doors) as listed below:

1. Single Swing Doors - 3 per door.
2. Pairs of Doors - 2 per door.
3. Dutch Doors - 4 per door.

3.5 HARDWARE SCHEDULE

A. Provide hardware for each door to comply with requirements of this section, hardware set numbers indicated in door schedule; in above schedules of weatherstripping and seals, door silencers, and door stops; and in following schedule of hardware sets. Provide hardware for all doors. In the event a hardware set is not noted, provide hardware as scheduled for similar doors. All hardware will comply with fire rating requirements and all code requirements.

HW SET: 01
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1HW NRP	630	IVE
1	EA	PANIC HARDWARE	98EO		VON
1	EA	DOOR POSITION SWITCH	BY SECURITY		
1	EA	SURFACE CLOSER	4111 SCUSH		LCN
1	EA	THRESHOLD	896VV		NGP
1	SET	SEALS	160S		NGP
1	EA	DOOR SWEEP	200SA		NGP
1	EA	DRIP CAP	16A		NGP

COORDINATE INSTALLATION WITH SECURITY.

HW SET: 02
DOOR NUMBER:

EACH TO HAVE:

3	EA	1E7 AS REQUIRED OR PADLOCK	5BB1	IVE

COORDINATE WITH DOOR SUPPLIER

HW SET: 03
DOOR NUMBER:

EACH TO HAVE:

4	EA	HINGE	5BB1	IVE
1	EA	DUTCH DOOR BOLT	054	IVE
1	EA	OFFICE LOCK	L9050L	SCH
1	EA	MORTISE CYLINDER	1E74	BES
1	EA	KICK PLATE	8400	IVE
1	EA	FLOOR STOP	FS441	IVE
1	EA	WALL STOP	WS407CCV	IVE
1	SET	SEALS	5020	NGP

COORDINATE HARDWARE WITH DOOR MANUFACTURER.

HW SET: 04
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1	IVE
1	EA	OFFICE LOCK	L9050L	SCH
1	EA	MORTISE CYLINDER	1E74	BES
1	EA	SURFACE CLOSER	4111 CUSH	LCN
1	EA	KICK PLATE	8400	IVE
1	SET	SEALS	5020	NGP

HW SET: 05
DOOR NUMBER:

EACH TO HAVE:

6	EA	HINGE	5BB1HW	IVE
2	EA	FIRE EXIT HARDWARE	9847L-F-BE-LBR X 06	VON
2	EA	SURFACE CLOSER	4011	LCN
2	EA	MAGNETIC HOLD-OPEN	SEM 7850	LCN
1	SET	SEALS	5020	NGP

COORDINATE INSTALLATION WITH FIRE AND ELECTRICAL SYSTEMS.

WOOD DOOR EDGE - NO METAL EDGE!!

HW SET: 06
DOOR NUMBER:

EACH TO HAVE:

6	EA	HINGE	5BB1HW	IVE
2	EA	FIRE EXIT HARDWARE	9847L-F-BE-LBR X 06	VON
2	EA	SURFACE CLOSER	4011	LCN
2	EA	KICK PLATE	8400	IVE
2	EA	MAGNETIC HOLD-OPEN	SEM 7850	LCN
1	SET	SEALS	5020	NGP

COORDINATE INSTALLATION WITH FIRE AND ELECTRICAL SYSTEMS.

WOOD DOOR EDGE - NO METAL EDGE!!

HW SET: 07
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1	IVE
1	EA	OFFICE LOCK	L9050L	SCH
1	EA	MORTISE CYLINDER	1E74	BES
1	EA	FLOOR STOP	FS441	IVE
1	SET	SEALS	5020	NGP

HW SET: 08
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1	IVE
1	EA	PRIVACY SET	L9440 X X09-611 X L583-375	SCH
1	EA	SURFACE CLOSER	4111 SCUSH	LCN
1	EA	KICK PLATE	8400	IVE
1	SET	SEALS	5020	NGP

HW SET: 09
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1	IVE
1	EA	CORRIDOR LOCK	L9456L	SCH
1	EA	MORTISE CYLINDER	1E74	BES
1	EA	SURFACE CLOSER	4111 SCUSH	LCN
1	EA	KICK PLATE	8400	IVE
1	SET	SEALS	5020	NGP

HW SET: 10
DOOR NUMBER:

EACH TO HAVE:

6	EA	HINGE	5BB1HW	IVE
2	EA	MANUAL FLUSH BOLT	FB458	IVE
1	EA	DUST PROOF STRIKE	DP2	IVE
1	EA	CORRIDOR LOCK	L9456L	SCH
1	EA	MORTISE CYLINDER	1E74	BES
1	EA	SURFACE CLOSER	4111 SHCUSH	LCN
1	EA	OVERHEAD HOLDER	900H	GLY
2	EA	ARMOR PLATE	8400	IVE
1	SET	SEALS	5020	NGP

HW SET: 11
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1		IVE
1	EA	CORRIDOR LOCK	L9456L		SCH
1	EA	MORTISE CYLINDER	1E74		BES
1	EA	KICK PLATE	8400		IVE
1	EA	FLOOR STOP	FS441		IVE
1	SET	SEALS	5020		NGP

HW SET: 12
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1		IVE
1	EA	CORRIDOR LOCK	L9456L		SCH
1	EA	MORTISE CYLINDER	1E74		BES
1	EA	OVERHEAD HOLDER	900H		GLY

HW SET: 13
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1HW NRP	630	IVE
1	EA	PANIC HARDWARE	98EO		VON
1	EA	DOOR POSITION SWITCH	BY SECURITY		
1	EA	SURFACE CLOSER	4111 SCUSH		LCN
1	EA	THRESHOLD	896VV		NGP
1	SET	SEALS	160S		NGP
1	EA	DOOR SWEEP	200SA		NGP
1	EA	DRIP CAP	16A		NGP

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS.

HW SET: 14
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1HW	IVE
1	EA	PUSH PLATE	8200 8" X 16"	IVE
1	EA	PULL PLATE	8303-8 4" X 16"	IVE
1	EA	SURFACE CLOSER	4040	LCN
1	EA	KICK PLATE	8400	IVE
1	EA	MOP PLATE	8400	IVE
1	EA	WALL STOP	WS407CCV	IVE

HW SET: 15
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1HW NRP	630	IVE
1	EA	CORRIDOR LOCK	L9456L		SCH
1	EA	MORTISE CYLINDER	1E74		BES
1	EA	DOOR POSITION SWITCH	BY SECURITY		
1	EA	SURFACE CLOSER	4111 SHCUSH		LCN
1	EA	KICK PLATE	8400		IVE
1	EA	THRESHOLD	425HD		NGP
1	SET	SEALS	160S		NGP
1	EA	DOOR SWEEP	200SA		NGP
1	EA	DRIP CAP	16A		NGP

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS.

HW SET: 16
DOOR NUMBER:

EACH TO HAVE:

6	EA	HINGE	5BB1HW	IVE
1	EA	MULLION	KR9954 X 499	VON
2	EA	FIRE EXIT HARDWARE	98L-F X 06	VON
2	EA	RIM CYLINDER	1E72	BES
1	EA	MORTISE CYLINDER	1E74 (FOR KR)	BES
2	EA	SURFACE CLOSER	4111	LCN
2	EA	KICK PLATE	8400	IVE
2	EA	FLOOR STOP	FS441	IVE
1	EA	THRESHOLD	413	NGP
2	SET	SEALS	S88	PEM
2		DOOR BOTTOM	423N	NGP

COORDINATE SEALS TO STC DOOR MANUFACTURER.

HW SET: 17
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1 NRP	IVE
1	EA	STOREROOM LOCK	L9080L	SCH
1	EA	MORTISE CYLINDER	1E74	BES
1	EA	DOOR POSITION SWITCH	BY SECURITY	
1	EA	SURFACE CLOSER	4111 HCUSH	LCN
1	EA	THRESHOLD	896VV	NGP
1	SET	SEALS	160S	NGP
1	EA	DOOR SWEEP	200SA	NGP
1	EA	DRIP CAP	16A	NGP

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS.

HW SET: 18
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1 NRP	IVE
1	EA	PANIC HARDWARE	98NL	VON
1	EA	RIM CYLINDER	1E72	BES
1	EA	DOOR POSITION SWITCH	BY SECURITY	
1	EA	SURFACE CLOSER	4111 SHCUSH	LCN
1	EA	THRESHOLD	896VV	NGP
1	SET	SEALS	160S	NGP
1	EA	DOOR SWEEP	200SA	NGP
1	EA	DRIP CAP	16A	NGP

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS.

HW SET: 19
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1	IVE
1	EA	FIRE EXIT HARDWARE	98EO-F	VON
1	EA	SURFACE CLOSER	4011	LCN
1	EA	KICK PLATE	8400	IVE
1	EA	FLOOR STOP	FS441	IVE
1	EA	THRESHOLD	413	NGP
1	SET	SEALS	5020	NGP
1	EA	DOOR SWEEP	200SA	NGP

HW SET: 20
DOOR NUMBER:

EACH TO HAVE:
REUSE EXISTING HARDWARE

HW SET: 21
DOOR NUMBER:

EACH TO HAVE:

6	EA	HINGE	5BB1HW	IVE
2	EA	PUSH PLATE	8200 4" X 16"	IVE
2	EA	PULL PLATE	8303-8 4" X 16"	IVE
2	EA	SURFACE CLOSER	4111	LCN
2	EA	FLOOR STOP	FS441	IVE
1	EA	THRESHOLD	413	NGP
2	SET	SEALS	S88	PEM
2		DOOR BOTTOM	423N	NGP

COORDINATE SEALS TO STC DOOR MANUFACTURER.

HW SET: 22
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1HW	IVE
1	EA	CORRIDOR LOCK	L9456L	SCH
1	EA	MORTISE CYLINDER	1E74	BES
1	EA	SURFACE CLOSER	4011	LCN
1	EA	KICK PLATE	8400	IVE
1	EA	FLOOR STOP	FS441	IVE
1	EA	THRESHOLD	413	NGP
2	SET	SEALS	S88	PEM
1		DOOR BOTTOM	423N	NGP

COORDINATE SEALS TO STC DOOR MANUFACTURER.

HW SET: 23
DOOR NUMBER:

EACH TO HAVE:

6	EA	HINGE	5BB1	IVE
2	EA	MANUAL FLUSH BOLT	FB358	IVE
1	EA	DUST PROOF STRIKE	DP2	IVE
1	EA	CORRIDOR LOCK	L9456L	SCH
1	EA	MORTISE CYLINDER	1E74	BES
1	SET		ME SEAL & ASTRAGAL BY DOOR MFG	
1	EA	SURFACE CLOSER	4111	LCN
1	EA	OVERHEAD STOP	900S	GLY
2	EA	KICK PLATE	8400	IVE
1	SET	SEALS	5020	NGP

HW SET: 24
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1HW		IVE
1	EA	STOREROOM LOCK	L9080L		SCH
1	EA	MORTISE CYLINDER	1E74		BES
1	EA	SURFACE CLOSER	4111 CUSH		LCN
1	EA	KICK PLATE	8400		IVE
1	EA	THRESHOLD	413		NGP
1	SET	SEALS	5020		NGP
1	EA	DOOR BOTTOM	420SA		NGP

COORDINATE SEALS TO STC DOOR MANUFACTURER.

HW SET: 25
DOOR NUMBER:

EACH TO HAVE:

6	EA	HINGE	5BB1HW NRP	630	IVE
2	EA	MANUAL FLUSH BOLT	FB458		IVE
1	EA	CORRIDOR LOCK	L9456L		SCH
1	EA	MORTISE CYLINDER	1E74		BES
2	EA	DOOR POSITION SWITCH	BY SECURITY		
2	EA	SURFACE CLOSER	4111 SHCUSH		LCN
1	EA	THRESHOLD	896VV		NGP
1	SET	SEALS	160S		NGP
2	EA	DOOR SWEEP	200SA		NGP
1	EA	DRIP CAP	16A		NGP
1	EA	ASTRAGAL	BY DOOR MANUFACTURER		

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS

HW SET: 26
DOOR NUMBER:

EACH TO HAVE:

4	EA	HINGE	5BB1		IVE
1	EA	STOREROOM LOCK	L9080L		SCH
1	EA	MORTISE CYLINDER	1E74		BES
1	EA	SURFACE CLOSER	4011		LCN
1	EA	FLOOR STOP	FS441		IVE
1	SET	SEALS	5020		NGP

HW SET: 27
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1HW	IVE
1	EA	FIRE EXIT HARDWARE	98L-F-BE	VON
1	EA	SURFACE CLOSER	4011	LCN
1	EA	KICK PLATE	8400	IVE
1	EA	FLOOR STOP	FS441	IVE
1	SET	SEALS	5020	NGP
1	EA	DOOR SWEEP	C607A	NGP

HW SET: 28
DOOR NUMBER:

EACH TO HAVE:

6	EA	HINGE	5BB1HW	IVE
1	SET	AUTO FLUSH BOLT	FB42	IVE
1	EA	PASSAGE SET	L9010	SCH
2	EA	SURFACE CLOSER	4031 X 180 DEG	LCN
2	EA	MAGNETIC HOLD-OPEN	SEM 1960	LCN
1	SET	SEALS	5020	NGP

COORDINATE INSTALLATION WITH FIRE AND ELECTRICAL SYSTEMS.

HW SET: 29
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1	IVE
1	EA	CORRIDOR LOCK	L9456L	SCH
1	EA	MORTISE CYLINDER	1E74	BES
1	EA	SURFACE CLOSER	4011	LCN
1	EA	KICK PLATE	8400	IVE
1	EA	FLOOR STOP	FS441	IVE
1	SET	SEALS	5020	NGP

HW SET: 30
DOOR NUMBER:

EACH TO HAVE:

3	EA	HINGE	5BB1	IVE
1	EA	CORRIDOR LOCK	L9456L	SCH
1	EA	MORTISE CYLINDER	1E74	BES
1	EA	SURFACE CLOSER	4111	LCN
1	EA	KICK PLATE	8400	IVE
1	SET	SEALS	5020	NGP

INSTALL CLOSER TO SWING 180 DEGREES.

HW SET: AL-1
DOOR NUMBER:

EACH TO HAVE:

1	EA	CONTINUOUS HINGE	112HD	IVE
1	EA	PANIC HARDWARE	35A-EO	VON
1	EA	DOOR POSITION SWITCH	BY SECURITY	
1	EA	SURFACE CLOSER	4110 SCUSH X 4110-13 X 30 X 61	LCN
1	EA	THRESHOLD	896VV	NGP
1	SET	DOOR SEALS	BY DOOR MANUFACTURER	
1	EA	DOOR BOTTOM	BY DOOR MANUFACTURER	
1	EA	DRIP CAP	16A	NGP

COORDINATE INSTALLATION WITH SECURITY, FIRE AND ELECTRICAL SYSTEMS.

HW SET: AL-2
DOOR NUMBER:

EACH TO HAVE:

2	EA	CONTINUOUS HINGE	112HD	IVE
2	EA	POWER TRANSFER	EPT-10	VON
1	EA	MULLION	KR1654 X 1606	VON
2	EA	PANIC HARDWARE	RX-LX-35A-EO	VON
1	EA	MORTISE CYLINDER	1E74	BES
2	EA	DOOR POSITION SWITCH	BY SECURITY	
2	EA	OFFSET DOOR PULL	8190-0-O	IVE
2	EA	CONCEALED CLOSER	2030 X 169 X ST 2211	LCN
2	EA	OVERHEAD STOP	900S	GLY
1	SET	DOOR SEALS	BY DOOR MANUFACTURER	
2	EA	DOOR BOTTOM	BY DOOR MANUFACTURER	
1	EA	THRESHOLD	426 X RCE	NGP
1	EA	ASTRAGAL	BY DOOR MANUFACTURER	

COORDINATE INSTALLATION WITH SECURITY, FIRE AND ELECTRICAL SYSTEMS.

HW SET: AL-3
DOOR NUMBER:

EACH TO HAVE:

2	EA	CONTINUOUS HINGE	112HD	IVE
2	EA	POWER TRANSFER	EPT-10	VON
1	EA	MULLION	KR1654 X 1606	VON
	EA	POWER SUPPLY	PS873-2-BB	VON
1	EA	PANIC HARDWARE	RX-35A-EO	VON
1	EA	PANIC HARDWARE	RX-EL35A-NL-OP	VON
1	EA	RIM CYLINDER	1E72	BES
1	EA	MORTISE CYLINDER	1E74 (FOR KR)	BES
1	EA	ACCESS CONTROL	BY SECURITY	
2	EA	DOOR POSITION SWITCH	BY SECURITY	
2	EA	OFFSET DOOR PULL	8190-0-O	IVE
2	EA	SURFACE CLOSER	4111 SCUSH X 4110-18 X 30 X 61	LCN
1	EA	AUTO. OPERATOR	2860 X HEADER X PUSH-N-GO	LCN
	EA	WEATHER RING	8310-801	LCN
1	EA	ACTUATOR, JAMB MOUNT		8310-818
	LCN			
1	EA	ACTUATOR, WALL MOUNT		8310-853T
	LCN			
1	EA	BOLLARD POST	8310-866	LCN
1	EA	FLUSH MOUNT BOX	8310-867F	LCN
1	SET	DOOR SEALS	BY DOOR MANUFACTURER	
2	EA	DOOR BOTTOM	BY DOOR MANUFACTURER	
1	EA	THRESHOLD	426 X RCE	NGP
1	EA	ASTRAGAL	BY DOOR MANUFACTURER	

COORDINATE INSTALLATION WITH SECURITY, FIRE AND ELECTRICAL SYSTEMS.

PAINT AUTOMATIC OPERATOR COVER TO MATCH STORE FRONT COLOR (AF-1).

HW SET: AL-4
DOOR NUMBER:

EACH TO HAVE:

1	EA	CONTINUOUS HINGE	112HD	IVE
1	EA	POWER TRANSFER	EPT-10	VON
1	EA	POWER SUPPLY	PS873-2-BB	VON
1	EA	PANIC HARDWARE	RX-LX-EL35A-NL-OP	VON
1	EA	RIM CYLINDER	1E72	BES
1	EA	ACCESS CONTROL	BY SECURITY	
1	EA	DOOR POSITION SWITCH	BY SECURITY	
1	EA	OFFSET DOOR PULL	8190-0-O	IVE
1	EA	AUTO. OPERATOR	2810 X HEADER X PUSH-N-GO	LCN
1	EA	WEATHER RING	8310-801	LCN
1	EA	ACTUATOR, JAMB MNT	8310-818	LCN
1	EA	ACTUATOR, WALL MNT	8310-853T	LCN
1	EA	BOLLARD POST	8310-866	LCN
1	EA	FLUSH MOUNT BOX	8310-867F	LCN
1	SET	DOOR SEALS	BY DOOR MANUFACTURER	
1	EA	DOOR BOTTOM	BY DOOR MANUFACTURER	
1	EA	THRESHOLD	426 X RCE	NGP

COORDINATE INSTALLATION WITH SECURITY, FIRE AND ELECTRICAL SYSTEMS.

PAINT AUTOMATIC OPERATOR COVER TO MATCH STORE FRONT COLOR (AF-1).

HW SET: AL-5
DOOR NUMBER:

EACH TO HAVE:

1	SET	PIVOT SET	MFG STANDARD X INTERMEDIATE	
1	EA	LEVER	4568	ADA
1	EA	DEADLATCH	4900	ADA
1	EA	MORTISE CYLINDER	1E76	BES
1	EA	PULL/PUSHBAR	9190-0-NO	IVE
1	EA	CONCEALED CLOSER	MFG STD OVERHEAD CONCEALED CLOSER	
1	EA	FLOOR STOP	FS441	IVE
1	SET	DOOR SEALS	BY DOOR MANUFACTURER	
1	EA	THRESHOLD	SEE DETAILS	

NO FLOOR STOP AT DOOR 1.301.

COORDINATE INSTALLATION WITH FIRE AND ELECTRICAL SYSTEMS.

HW SET: AL-6
DOOR NUMBER:

EACH TO HAVE:

2	SET	PIVOT SET	MFG STANDARD X INTERMEDIATE	
2	EA	PANIC HARDWARE	3547A-L-BE	VON
2		CONCEALED CLOSER	MFG STANDARD - 180 DEG SWING	
2	EA	MAGNETIC HOLD-OPEN	SEM 7850	LCN

COORDINATE INSTALLATION WITH FIRE AND ELECTRICAL SYSTEMS.

END OF SECTION

GEORGIA STATE INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 088000

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes glass, glazing and supplementary items necessary to complete their installation including glass specified in other sections where glazing requirements are specified by reference to this section.

B. Mirrored glass and glazing requirements are specified in Division 08 Section "Mirrors".

C. Structural silicone sealant glazing requirements for wall systems are specified in Division 08 Section "Glazed Aluminum Wall Systems".

1.2 DEFINITIONS

A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.

B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

C. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

D. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

E. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:

   a. Design Wind Loads: As indicated on drawings "Design Wind Pressures".
   b. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action for minimum of 60 seconds duration.
   c. Maximum Lateral Deflection: For the following types of glass supported on all four edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.

      1) For monolithic-glass lites heat treated to resist wind loads.
      2) For insulating glass.
      3) For laminated-glass lites.

   d. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm (1/4 inch).
   e. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

2. Human Impact Loads: Locations indicated, and as defined by building code; glazed with safety glass.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties based on manufacturer's current published test data.

1.4 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For each glass product and glazing material, in the form of 12-inch-square Samples for glass (except clear) and of 12-inch-long Samples for glazing material.

C. Shop Drawings: Show details of each type glazing system in conjunction with framing system indicating type of glass, sizes, shapes, glazing material and quantity. Show details indicating glazing material and thickness, bite on glass, glass edge clearance, depth of rabbet and thickness of glass.

D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1. Certifications attesting application and use of glass for effects of thermal loading under expected service temperature ranges has been reviewed, and specified maximum probabilities of breakage will not be exceeded.
2. Certifications attesting performance for specified design wind load criteria, has been reviewed; furnish design factor, statistical probability of breakage and center deflection for the largest size of each thickness and type.
3. Certifications attesting face pressure of heat-strengthened glass units falls within limits specified. Glass determined to be outside these limits shall be replaced at no cost to Owner.
4. Certification from manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.

F. Product Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

B. Source Limitations for Glass: Obtain glass from one manufacturer for each type of glass product indicated.

C. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

D. Safety Glass:

1. Products Not Permitted: Wired Glass.
2. Acceptable Products: Complying with CSPC 16 CFR 1201, Category II.
3. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

E. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. Laminated Glass: GANA Publications "Glazing Manual" and "Laminated Glass Design Guide."
2. Insulating Glass:

   a. SIGMA Publication TM-3000, "Vertical Glazing Guidelines."

F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following inspecting and testing agency:

1. Insulating Glass Certification Council.

G. Field-Constructed Mock-ups: Furnish glass and glazing material for visual mock-up specified in Division 01 Section "Visual Mock-Up Requirements".

H. Coated Vision Glass: Following coating quality criteria shall apply for vision areas viewed from indicated distance, against a bright, uniform background. As applied to following criteria, vision area shall extend to within three (3) inches of the perimeter of glass panel.

1. Pinholes: At distance of six (6) feet or more, pinholes greater than 1/16-inch-diameter shall not be allowed. Large clusters or close spacing of smaller pinholes shall not be allowed within vision area. Clusters are allowed outside the vision area, provided they are not obvious.
2. Reflectance, Transmission and Color: At distance of ten (10) feet or more, color, reflectance and transmission may vary slightly and be considered acceptable. Reflectance variations of plus or minus 1.5 percent are permissible.
3. Scratches: At distance of ten (10) feet or more, scratches exceeding 1/2 inch shall not be permitted if located in vision area.

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.8 WARRANTY

A. Manufacturer's Special Warranty: Written warranty, made out to Owner and signed by glass manufacturer agreeing to furnish replacements for those glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Coated Glass: Manufacturer's standard but not less than 10 years after date of Material Completion.
2. Laminated Glass: Manufacturer's standard but not less than 5 years after date of Material Completion.
3. Insulating Glass: Manufacturer's standard but not less than 10 years after date of Material Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide specific product, material or manufacturer listed under each item below.

2.2 PRIMARY FLOAT GLASS

A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Class as indicated below, and Quality q3 (glazing select), Class as indicated in schedule.

1. Refer to Glass Schedule at end of this Section.
2. Acceptable Manufacturers:

a. AFG Industries
b. Guardian Industries Corporation
c. Pilkington Libbey-Owens-Ford
d. PPG Industries, Inc. (PPG)

2.3 HEAT-TREATED FLOAT GLASS

A. Fabrication Process: By horizontal (roller-hearth) process. Maintain maximum surface compression for heat strengthened glass of 7500 psi.

B. Heat-Treated Float Glass: ASTM C 1048, Condition A (uncoated surfaces), Type I (transparent glass, flat), Quality q3 (glazing select), kind and class as indicated below.

1. Kind HS (heat strengthened) where indicated or recommended by manufacturer to comply with system performance requirements specified.
2. Kind FT (fully tempered) where indicated or required for safety glazing.
3. Class 1 (clear) unless otherwise indicated.
4. Class 2 (tinted heat-absorbing and light-reducing), where indicated.

2.4 CERAMIC-COATED GLASS

A. Ceramic-Coated Vision Glass: Float glass with ceramic coating applied by silk-screened process and complying with ASTM C 1048, Condition C (other coated glass), Type I (transparent glass, flat), Quality q3 (glazing select); and GTA 95-1-31, "Specification for Decorative Architectural Flat Glass".

B. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B (spandrel glass, one-surface ceramic coated), Type I (transparent glass, flat), Quality q3 (glazing select.

1. Kind HS (Heat strengthened) unless otherwise recommended by manufacturers.
2. Fallout Resistance: Provide spandrel units identical to those passing the fallout-resistance test for spandrel glass specified in ASTM C 1048 if units are fully tempered.

C. Refer to Glass Schedule at end of this Section.

2.5 COATED FLOAT GLASS

A. General: Provide Kind HS (heat-strengthened) coated float glass in place of coated annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified. Provide Kind FT (fully tempered) where safety glass is indicated.

B. Coated Vision Glass: Float glass with solar-reflective metallic-oxide or metallic-nitride coating applied by pyrolytic or vacuum deposition process after or during initial manufacture.

C. Coated Spandrel Glass: Float glass complying with requirements specified for vision glass.

1. Kind HS (heat strengthened) unless otherwise recommended by glass manufacturer.
2. Fallout Resistance: Provide spandrel units identical to those passing ASTM C 1048 fallout resistance test for spandrel glass if units are fully tempered.
3. Factory apply manufacturer's standard opacifier material to second surface of lites with resulting products complying with GTA Specification No. 89-1-6.

a. Polyester film laminated to glass with solvent-based adhesive.
b. Black opaque scrim, 10 mm thick.
c. Resistant to ultraviolet (UV) attack.
d. Retard moisture penetration and resist temperatures of 225 deg F.
e. Provide uniform appearance.

D. Refer to Glass Schedule at end of this Section.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Preassembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in the Glass Schedule at the end of Part 3.

1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified.
2. Kind FT (fully tempered) where indicated or required for Safety Glazing.
3. When tempered glass is utilized to comply with safety glazing requirements, both the inner and outer light shall be tempered glass.
4. Provide Edge Spacer of anodized or mill-finished aluminum, continuously bent and mechanically jointed.
5. Provide desiccant to insure maximum absorption of moisture and hydrocarbons liberated from the edge sealant during the curing cycle.
6. Provide Dual seal consisting of polyisobutyl (butyl) primary seal and secondary seal of silicone.

B. Refer to Glass Schedule at end of this Section.

2.7 ELASTOMERIC GLAZING SEALANTS

A. Provide Medium-Modulus Neutral-Curing Silicone Glazing Sealant products complying with the following:

1. Acceptable Manufacturers and Products:

a. Dow Corning; 795.
b. GE Silicones; Silglaze II.
c. Pecora Corporation; 895.

2. Type and Grade: S (single component) and NS (nonsag).
3. Additional Movement Capability: 50 percent movement in extension and 50 percent movement in compression for a total of 100 percent movement.
4. Use Related to Exposure: NT (nontraffic).
5. Color: As selected from manufacturer's full range of colors.

B. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

C. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

D. Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied, chemically curing sealant including those referencing ASTM C 920 classifications for type, grade, class, and uses.

1. Additional Movement Capability: Provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements in ASTM C 920 for uses indicated.

E. Glazing Sealant for Fire-Resistive Glazing Products: Identical to product used in test assembly to obtain fire-protection rating.

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

2.9 GLAZING GASKETS

A. Dense Compression Gaskets: ASTM C 864 or C 1115, molded or extruded gaskets of neoprene, EPDM, silicone, thermoplastic polyolefin rubber and of profile and hardness required to maintain watertight seal.

B. Soft Compression Gaskets: Extruded or molded closed-cell, integral-skinned gaskets of neoprene, EPDM, silicone, or thermoplastic polyolefin rubber, complying with ASTM C 509, Type II, black, and of profile and hardness required to maintain watertight seal.

1. Provide factory pre-molded, vulcanized or heat welded corners, for continuous, joint-free glazing material around sides of the glazing rabbet. Field-cut corners not allowed.
2. Provide gasket slightly longer than opening to be filled, as recommended by gasket manufacturer.

2.10 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.11 FABRICATION

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

B. Butt-glazing: Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces. Grind smooth and polish exposed glass edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Provide glazing channel dimensions necessary for bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

G. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

H. Set tempered glass so that tong marks are concealed within frame or furnish horizontal tempered glass without tong marks.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops.

D. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass.

E. Install gaskets so they protrude past face of glazing stops. Seal gasket joints with sealant recommended by gasket manufacturer.

F. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

G. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

C. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

D. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

3.8 GLASS SCHEDULE

Glass Type GL-1: Typical Vision Glazing.
Basis of Design: Viracon VE1-2M, Low E, heat strengthened.
Thicknesst: 1 inch.

Glass Type GL-2: Typical Spandrel.
Basis of Design: Viracon to match VE1-2M with ceramic frit.
Thickness: 1/4 inch.

Glass Type GL-3: Typical Vision Glazing.
Basis of Design: Viracon VE1-2M, Low E, fully tempered.
Thickness: 1 inch.

Glass Type GL-4: 1/4-inch-thick clear float glass.

Glass Type GL-5: 1/4-inch-thick fully tempered clear glass.

Glass Type GL-6: Not Used.

Glass Type GL-7: 1/2-inch-thick fully tempered clear glass.

3.9 GLAZING SCHEDULE

A. Tape Glazing:

1. Interior door glass lites.
2. Interior borrowed lights less than 75 united inches.

B. Sealant and Tape Glazing:

1. Exterior door glass lites.
2. Interior borrowed lights greater than 75 united inches.

C. Compression Gasket Glazing:

1. Curtainwall.
2. Store Front.
3. Entrances.

D. Butt Joint Silicone Glazing:

1. Curtainwall.

END OF SECTION

SECTION 08 8300

MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes unframed mirrored glass and supplementary items necessary to complete their installation.

B. Metal-framed mirror units are specified in Division 10 Section "Toilet Accessories."

1.2 DEFINITIONS

A. Deterioration of Silvered Mirrored Glass: Defects developed from normal use that are attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning silvered mirrored glass contrary to mirrored glass manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Silvered mirrored glass. Include description of materials and process used to produce mirrored glass that indicates source of glass, glass coating components, edge sealer, and quality-control provisions.
2. Mirror mastic.
3. Mirror hardware.

B. Shop Drawings: Include elevations, sections, details, and attachments to other Work.

C. Samples: For the following products, in sizes indicated below:

1. Mirrored glass, 6 inches square, including edge treatment on 2 adjoining edges.
2. Mirror clips.
3. Mirror trim, 6 inches long.

D. Product Certificates: Signed by manufacturers of mirrored glass certifying that products furnished comply with requirements.

E. Mirror Mastic Glass Coating Compatibility Test Reports: From an organic protective coating manufacturer indicating that mirror mastic has been tested for compatibility and adhesion with organic protective coating applied to silvered mirrored glass. Include organic coating manufacturers' interpretation of test results relative to performance and recommendations for use of mastics with organic protective coating.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in mirrored glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

B. Source Limitations for Mirrored Glass: Obtain mirrored glass from one source for each type of mirrored glass indicated.

C. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each type of accessory indicated.

D. Glazing Publications: Comply with published recommendations in GANA's "Glazing Manual," unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.

E. NAAMM's Publication: For silvered mirrored glass, comply with recommendations in NAAMM's "Mirrors, Handle with Extreme Care, Tips for the Professional on the Care and Handling of Mirrors."

F. Preconstruction Mirror Mastic Glass Coating Compatibility Test: Submit mirror mastic products to organic protective coating manufacturer for testing to determine compatibility of adhesive with mirrored glass coating.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to mirrored glass manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirrored glass manufacturer's written instructions for shipping, storing, and handling mirrored glass as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors, protected from moisture including condensation.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install mirrored glass until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.7 WARRANTY

A. Manufacturer's Special Warranty: Written warranty made out to Owner and signed by mirrored glass manufacturer agreeing to replace silvered mirrored glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within five years from date of Material Completion.

PART 2 - PRODUCTS

2.1 FLOAT GLASS

A. Annealed Float Glass: ASTM C 1036, Type I (transparent glass, flat), Class 1 (clear), Quality q2 (mirror), thickness 6mm (1/4 inch).

2.2 FABRICATION

A. Silvered Mirrored Glass: Float glass with successive layers of chemically deposited silver, electrically or chemically deposited copper, and manufacturer's standard organic protective coating applied to second glass surface to produce a coating system complying with FS DD-M-411.

B. Mirrored Glass Sizes: Cut mirrored glass to final sizes and shapes to suit Project conditions.

C. Cutouts: Fabricate cutouts for notches and holes in mirrored glass without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrored glass.

D. Mirrored Glass Edge Treatment: Treat edges as indicated below:

1. Seamed (swiped) edge.
2. Seal edges of silvered mirrored glass after edge treatment to prevent chemical or atmospheric penetration of glass coating.
3. Require mirrored glass manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

2.3 MISCELLANEOUS MATERIALS

A. Setting Blocks: Neoprene, 70 to 90 Shore A hardness.

B. Edge Sealer: Coating compatible with glass coating and approved by mirrored glass manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrored glass by spot application, certified by both mirrored glass manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrored glass will be installed.

D. Top and Bottom Trim: Type 304 stainless steel J-channels formed with a return deep enough to produce a glazing channel to accommodate mirrored glass units of thickness indicated and in lengths required to cover bottom edge of each mirrored glass unit in a single piece.

1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.05 inch (18 gage).
2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.0375 inch (20 gage).
3. Fastener Holes: Minimum 6 inches on center with countersunk face for flush screw application, slotted holes for top trim.
4. Finish: No. 4 satin finish.

E. Fasteners: Stainless steel flat head machine screws.

F. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrored glass units are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, location of anchor plates, and other conditions affecting performance.

1. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
2. Proceed with mirrored glass installation only after unsatisfactory conditions have been corrected and surfaces are dry.
3. Starting work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating surfaces with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrored glass units to comply with written instructions of mirrored glass manufacturer and with referenced GANA and NAAMM publications. Mount mirrored glass accurately in place in a manner that avoids distorting reflected images.

B. Provide space for air circulation between back of mirrored glass units and face of mounting surface.

C. Install permanent means of support at bottom and top edges with bottom support designed to withstand mirrored glass weight and top support designed to prevent mirrored glass from coming away from wall along top edges.

1. Unless otherwise indicated, install continuous bottom and top trim. Fabricate trim in single lengths to fit and cover top and bottom edges of mirrored glass units.
2. Attach mirror hardware securely to steel back up plates with mechanical fasteners and anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrored glass units.
3. For continuous bottom supports, provide setting blocks 1/8-inch-thick by 4 inches long at quarter points. For channel supports in which water could be trapped between setting blocks, provide two slotted weeps not less than 1/4-inch-wide by 3/8-inch-long.
4. Place a felt or plastic pad between back of mirrored glass and each fastener to prevent spalling of mirrored glass edges or damaging mirror backing.
5. Exercise extreme caution to avoid scratching silvering on mirror back during installation. Mirrors which are scratched, cracked, chipped or in any manner damaged shall be removed and replaced with new, undamaged mirrors.

D. Mastic Spot Installation System: In addition to top and bottom trim supports, install mirrored glass units with mastic as follows:

1. Apply barrier coat to mirrored glass backing where approved in writing by manufacturers of mirrored glass and backing material.
2. Apply mastic in spots to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrored glass units and face of mounting surface.
3. After mastic is applied, align mirrored glass units and press into place while maintaining a minimum air space of 1/8 inch between back of mirrored glass and mounting surface.

3.4 PROTECTION AND CLEANING

A. Protect mirrored glass from breakage and contaminating substances resulting from construction operations.

1. Do not permit edges of silvered mirrored glass to be exposed to standing water.
2. Maintain environmental conditions that will prevent silvered mirrored glass from being exposed to moisture from condensation or other sources for continuous periods of time.

B. Wash mirrored glass before date scheduled for inspections intended to establish date for Material Completion. Wash mirrored glass by methods recommended in NAAMM publication and in writing by mirrored glass manufacturer. Use water and glass cleaners free from substances capable of damaging mirrored glass edges or coatings.

END OF SECTION

SECTION 089100

WALL LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this Section includes wall louvers and supplementary items necessary to complete their installation.

1.2 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section, unless otherwise defined in this Section or in referenced standards.

B. Standard Free Area: Free area of a louver 48 inches wide by 48 inches high, identical to that provided.

C. Maximum Standard Airflow: Airflow at point of beginning water penetration through a louver 48 inches wide by 48 inches high, identical to that provided.

D. Drainable-Blade Louver: Louver designed to collect and drain water to exterior at sill by means of gutters in front edges of blades and channels in jambs and mullions.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide exterior metal louvers capable of withstanding the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; or permanent damage to fasteners and anchors.

1. Design: By professional engineer employed by louver manufacturer.
2. Wind Load: Uniform pressures (velocity pressures) required by applicable local code acting inward or outward. Refer to Design Wind Pressure Schedule on drawings.
3. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, and other detrimental effects:

    a. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

B. Air-Performance, Water-Penetration, and Air-Leakage Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's stock units 48 inches wide by 48 inches high.

1. Perform testing on unpainted, cleaned, degreased units.
2. Perform water-penetration testing on louvers without screens.
3. Test units according to AMCA 500-L.

1.4 SUBMITTALS

A. Product Data: For each type of product specified.

B. Shop Drawings: For louver units and accessories. Include plans; elevations; sections; and details showing profiles, angles, and spacing of louver blades. Show unit dimensions related to wall openings and construction; free area for each size indicated; profiles of frames at jambs, heads, and sills; and anchorage details and locations.

1. For louvers indicated to comply with design loadings, include shop drawings and structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Verification: Of each type of metal finish required, prepared on Samples of same thickness and material indicated for final Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

D. Product Certificates: Signed by manufacturers of louvers certifying that the products furnished comply with requirements and are licensed to bear the AMCA seal based on tests made according to AMCA 500-L and complying with AMCA's Certified Ratings Program.

1.5 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of louvers that are similar to those indicated for this Project in material, design, and extent.

B. Source Limitations: Obtain louvers through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

C. Welding Standards: As follows:

1. Comply with AWS D1.2, "Structural Welding Code--Aluminum."
2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

D. SMACNA Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 WARRANTY

A. Finish Warranty: Provide written warranty signed by manufacturer and installer, agreeing to repair or replace work which exhibits defects in finish. "Defects" is defined to include, but is not limited to, peeling, chipping, chalking, fading, abnormal aging or deterioration, and failure to perform as required.

1. Warranty Period for Fluoropolymer Finish: 10 years from date of application for color and film integrity.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Airline Products Co.
2. Airolite Co.
3. American Warming and Ventilating, Inc.
4. Arrow United Industries.
5. Construction Specialties, Inc.
6. Greenheck.
7. Industrial Louvers, Inc.
8. Nystrom Building Products.
9. Ruskin Company Tomkins PLC.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005, .032 inch minimum thickness with temper as required for forming, or as otherwise recommended by metal producer for required flashings.

C. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.

D. Postinstalled Fasteners: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1. Continuous Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates and without interrupting blade-spacing pattern.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining materials' tolerances, and perimeter sealant joints.

1. Frame Type: Channel type, unless otherwise indicated.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.

1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.

F. Provide sill extensions and loose sills made of same material as louvers where required for drainage to exterior and to prevent water penetrating to interior.

G. Join frame members to one another and to fixed louver blades with manufacturer's standard fillet welds or threaded fasteners concealed from view, unless size of louver assembly makes bolted connections between frame members necessary.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Continuous, Horizontal, Drainable-Blade Louvers: Fabricated with close-fitting, field-made splice joints in blades designed to permit expansion and contraction without deforming blades or framework and with mullions recessed from front edges of blades so blades have continuous appearance.

1. Louver Depth: 6 inches unless otherwise indicated.
2. Frame Thickness: 0.080 inch.
3. Blade Thickness: 0.080 inch.
4. Blade Profile: Continuous Dual Drain.
5. Mullion Profile: Semi Recessed.
6. Blade Angle and Spacing: 45 degrees and 6 inches o.c. for 6-inch-deep louvers.
7. Free Area: Not less than 7.8 sq. ft. for 48-inch-wide by 48-inch-high louver.
8. Point of Beginning Water Penetration: Not less than 850 fpm.
9. Air Performance: Not more than 0.10-inch wg static pressure drop at 850-fpm free-area velocity.
10. Product Standard: Construction Specialties Inc., Model A6155.

2.5 LOUVER SCREENS

A. General: Provide each exterior louver with louver screens complying with the following requirements:

1. Screen Location: Interior face, unless otherwise indicated.
2. Screening Type: Bird screening, unless otherwise indicated.

a. Insect screening, where indicated on the Drawings.

B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate screen frames with mitered corners to louver sizes indicated and to comply with the following requirements:

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
2. Finish: Same finish as louver frames to which louver screens are attached.
3. Bird Screen Type: Non-rewirable, U-shaped frames for permanently securing screen mesh.
4. Insect Screening Type: Rewirable frames with a driven spline or insert for securing screen mesh.

D. Louver Screening for Aluminum Louvers:

1. Bird Screening: Aluminum, 1/2-inch-square mesh, 0.063-inch wire.
2. Insect Screening: Aluminum, 18 by 16 (1.4 mm by 1.6 mm) mesh, 0.012 in (0.30 mm) wire.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish louvers after assembly.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Fluoropolymer Two-Coat Coating System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

a. Color and Gloss: AF-1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive wall louvers and associated work and conditions under which work will be installed. Do not proceed with installation until satisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 PREPARATION

A. Coordinate Setting Drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louver units level, plumb, and at indicated alignment with adjacent work. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection. Form closely fitted joints with exposed connections accurately located and secured. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.

B. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

C. Protect metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

D. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

3.4 CLEANING, AND PROTECTING

A. Clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

B. Protect louvers from damage during construction. Use temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at the time of Material Completion.

C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 09 2320

SPRAY-APPLIED ACOUSTICAL PLASTERING

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes sprayed-on decorative/acoustical insulation and supplementary items necessary to complete their installation.

1.2 ENVIRONMENTAL OBJECTIVES

A. The Owner has established environmental objectives and implementation strategies for this Project based upon the LEED Green Building Rating System™ Version 2.1 dated November 2002 and revised January 16, 2003 as developed by the U.S. Green Building Council. Refer to Division 01 Section "Sustainable Construction Requirements."

B. Manufacturer to supply documentation of level of compliance or non-compliance with the following requirements before consideration as an "acceptable manufacturer:"

1. The Design Team has determined that the following to be highly desirable objectives:

a. The products supplied contain recycled content. Recycled content materials shall be defined in accordance with the Federal Trade Commission document, *Guides for the Use of Environmental Marketing Claims, 16 CFR 260.7(e)*, available at www.ftc.gov/bcp/grnrule/ guides980427.htm.

b. The products supplied are manufactured regionally within a radius of 500 miles of this Project and/or these regionally manufactured products are composed of materials that are extracted, harvested or recovered (as well as manufactured) within 500 miles of this Project. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesmen.

C. Products that conform to requirements of the Environmental Objectives yet do not fully meet other requirements of this Section may still be considered for use at the sole discretion of the Owner and Architect.

1.3 SUBMITTALS

A. Manufacturer's installation instructions, test data substantiating compliance with quality assurance.

B. 12-inch-square sample of sprayed-on acoustical material showing texture variations for approval. Resubmit as required until approved. All samples must be certified by manufacturer that they are representative of the texture which was acoustically tested in supporting acoustical reports.

C. Test reports from all suppliers showing material to be 100 percent free of asbestos, mineral fiber, polystyrene and cellulose.

D. Certification of applicator licensing.

E. Acoustical test data for specified finish.

F. Environmental Objectives Documentation: Signed by vendors, suppliers and / or manufacturers documenting the furnished product's level of compliance / non-compliance with requirements of Environmental Objectives as stated in this Section.

1. Documentation attesting as to whether the products supplied contain recycled content as defined in accordance with the Federal Trade Commission document, *Guides for the Use of Environmental Marketing Claims, 16 CFR 260.7(e).*
2. Documentation attesting as to whether the products supplied were manufactured regionally within 500 miles of this Project and/or extracted, harvested or recovered (as well as manufactured) within 500 miles of this Project.

1.4 QUALITY ASSURANCE

A. Provide gypsum plaster-vermiculite material which has been tested to and achieved the following values:

1.

	TEST METHOD/ AUTHORITY	PROPERTY	VALUE
a.	ASTM E 605	Density	40 Lbs./Cu.Ft.
b.	ASTM E 761	Compressive Strength	64 psi.
c.	ASTM E 736-86	Bond Strength	2400 Lbs./Sq.Ft.
d.	ASTM E 84-87	Surface Burning Characteristics	0 Flame Spread 0 Smoke Developed
e.	ASTM C 423-84A	Sound Absorption	0.65 NRC @ 1" Thick 0.50 NRC @ 1/2" Thick
f.	University of Pittsburgh Toxicity Test	Toxicity	LC50 > 300 Grams
g.	ASTM E 136	Combustibility	Non-Combustible

B. Provide testing results and procedures which have been certified by Cedar Knolls Acoustical Labs (CNVLAP) or other accredited independent testing laboratories. Peak thickness of test samples must be determined and reported by acoustical laboratory. Nominal thicknesses are not acceptable unless peak thicknesses are also reported.

1. NRC not less than 0.50 at 1/2 inch thickness and coefficient not less than 0.31, (plus or minus 0.03) at 250 Hz. Conduct testing on solid backing with no air gap.

C. Installer: licensed by manufacturer.

D. Control Sample: Prior to installation of final coat, apply an area of 50 sq. ft. in presence of architect and acoustical consultant, for approval of finish texture, as selected from samples. Control samples shall look the same, and have the same thickness as submitted samples.

1.5 MATERIAL HANDLING

A. Keep material dry until ready for use.

1.6 WARRANTY

A. Manufacturer shall warrant the material to be supplied, agreeing to repair/replace that which has cracked, flaked, dusted excessively, peeled or fallen from substrate, or otherwise deteriorated to a condition where it would not perform effectively as intended for a sound absorbent purpose; due to defective materials and not due to abuse, improper maintenance, unforeseeable ambient exposures, or other causes beyond anticipated conditions by manufacturer. The warranty period will be 10 years from date of Material Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Cafco.
2. Pyrok.
3. US Gypsum.
4. WR Grace.

2.2 PRODUCT STANDARD

A. Product Standard: Pyrok, Inc.; Acoustement Plaster 40.

1. Texture: "Standard Texture".
2. Thickness: Minimum of 1/2 inch.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Examine all substrates and conditions.

B. Assure substrate is free of oil, grease, dirt, paint, or other matter which would impair bond or install metal lath as recommended by the manufacturer.

C. Do not proceed until said substrate and conditions are acceptable.

D. Prepare substrate by filling voids and cracks and offsets, remove projections that result in telegraphing presence of imperfections.

E. Prime substrate with primer or bonding agent as recommended by the manufacturer.

F. Do not apply insulation material when temperature is below 44 deg F (ambient), or substrate is below 40 deg F.

G. Mask all adjoining surfaces in order to minimize damage from overspray.

H. Provide ventilation if required, and avoid excess drying rates.

I. Provide tarps or temporary enclosures as necessary to confine operations.

J. Perform all patching and repairing of insulation required to be done due to cutting, etc., by other trades.

K. Allow each coating to dry between spray applications as recommended by the manufacturer.

L. Provide plastering pump as required by manufacturer.

3.2 APPLICATION

A. Apply in accordance with manufacturer's instructions (except no spray pass shall exceed 1/4" thickness using any rotary-stator plastering pump or other spray equipment approved by the manufacturer.

B. Install to thickness indicated or thickness required to achieve NRC specified.

C. Ensure that texture and color are all as per control sample.

D. If manufacturer recommends, apply an initial spray coat to improve binding to substrate. Metal lath, hardware cloth or chicken wire may also be required depending on thickness and manufacturing requirements.

3.3 CLEANING AND PATCHING

A. Remove overspray and fall out materials immediately upon completion of the work in each area. Clean surfaces to remove evidence of soiling. Repair or replace damaged work surfaces to acceptable conditions.

B. Coordinate work with other work, to minimize possibility of damage to insulation resulting from performance of subsequent work. As other units of work are completed in each area, patch damaged areas or surfaces of insulation by over spraying to match original installations, or by patching procedures as required to provide acceptable results.

END OF SECTION

GEORGIA STATE INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 09 2900

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Metal framing systems, interior gypsum board faced walls, partitions, and ceiling assemblies, and supplementary items necessary for installation.

1.2 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 for definitions of terms not defined in this Section or in other referenced quality standards.

B. Damage: Stored or installed paper-faced gypsum board materials not specifically manufactured as "moisture-resistant products" shall be classified as defective and nonconforming Work if they have been exposed to wetness or dampness at any time prior to Material Completion or if they exhibit evidence of active or dormant mold or mildew.

1.3 DELEGATED ENGINEERING REQUIREMENTS FOR GYPSUM BOARD ASSEMBLIES WITHSTANDING SEISMIC LOADS

A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems required to withstand seismic loads and do not necessarily indicate or specify total Work required and shall not be construed as engineered design. Furnish and install all Work required for a complete installation.

B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems required to withstand seismic loads including attachment to building structure required to meet design intent of Contract Documents including, but not limited to, the following.

1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer responsible for their preparation.

C. Coordination of Contract Documents and Work:

1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturer/fabricators. Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.

2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Include scaled and dimensioned drawings showing locations of control joints.

1. Gypsum Board Location Schedule: Provide detailed schedule in format similar to "Gypsum Board Schedule" at end of this Section indicating gypsum board products to be installed and their respective locations.

C. Shop Drawings for Engineered Gypsum Board Assemblies - Seismic Loads: Scaled and dimensioned drawings showing locations, fabrication, and installation of gypsum board assemblies required to withstand seismic loads, including plans, elevations, sections, details of components, and attachments to building structure; include seal and signature of delegated engineering professional responsible for their preparation.

D. Samples for Verification of Aluminum Trim Accessories: 12 in (300 mm) long samples indicating specified profile and finish.

E. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.

F. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

G. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control" Article.

H. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.

I. Qualification Data: For manufacturer, installer, and professional engineer.

1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
2. Architect may waive submittal of qualification data for available manufacturers listed in this Section.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years, and with sufficient production capability, facilities, and personnel to produce required Work.

B. Installer Qualifications:

1. Experience: Installer with not less than 5 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project site during times specified Work is in progress that is experienced in installing systems similar to type and scope required for Project.

C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated that have resulted in installations of products and systems similar to this Project and has a record of successful in-service performance.

D. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with minimum of 5 years experience in providing recommendations, observations, evaluations, and problem diagnostics. Sales representatives are not acceptable.

E. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

    a. Show typical components, attachments to building structure, and requirements of installation.
    b. Field Samples for Gypsum Board Finishing: Build 10 ft (3 m) square gypsum board (attached to metal studs) area for each finish level specified. Include not less than one tapered-to-tapered edge gypsum board joint and cut edge-to-cut edge gypsum board joint.

2. Clean exposed faces of mock-up.
3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Protect accepted mock-up from the elements with weather-resistant membrane.
6. Obtain Architect's acceptance of mockups before starting fabrication.
7. Maintain mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.
8. Acceptance of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and accepted by Architect in writing.
9. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

F. Fire Resistance Rated Assembly Characteristics: Provide materials and construction identical to those tested according to ASTM E 119/NFPA 251/UL 263 by one of following independent testing and inspecting agency as evidenced by design designation included in their associated approval manual:

1. UL - "Fire Resistance Directory", Category BXUV.
2. GA 600 - "Fire Resistance Design Manual".
3. Other agency acceptable to authorities having jurisdiction.

G. Smoke Resistance Rated Assembly Characteristics: Provide materials and construction identical to those tested according to indicated fire resistance rated assemblies by independent testing and inspecting agency.

H. Sound (STC) Resistance Rated Assembly Characteristics: Provide materials and construction identical to those tested according to ASTM E 90 and classified according to ASTM E 413 by independent and testing agency.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

a. Owner.
b. Architect.
c. Contractor, including superintendent.
d. Installer, including project manager and supervisor.
e. Manufacturer's qualified technical representative.
f. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Work requirements (Drawings, Specifications, and other Contract Documents).
c. Review required submittals, both completed and yet to be completed.
d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
e. Review required inspection, testing, certifying, and material usage accounting procedures.
f. Review environmental conditions and procedures for coping with unfavorable conditions.
g. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.8 PROJECT CONDITIONS

A. Environmental Conditions: Comply with ASTM C 840 requirements or respective gypsum board manufacturer's written recommendations, whichever are more stringent.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Available Manufacturers and Products: Manufacturers offering products that may be incorporated into the Work include those listed.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated and without permanent deformation or failure of materials.

B. Design Loads: Engineer to withstand design loads including but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable local building codes, and as indicated.

1. Structural Movement: Engineer to withstand movements of structure including, but not limited to, drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads. Contractor shall obtain required design data and identify movements accommodated on submittal drawings.

a. Accommodate plus or minus 3/8 in (10 mm) differential vertical deflection of floors.

C. Thermal Movements: Engineer products and systems to accommodate thermal movements of supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses, damaging loads on fasteners, failure of operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.

D. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 SUSPENDED GRID SYSTEM FOR INTERIOR CEILINGS

A. Suspension System:

1. Material Quality Standard: ASTM C 645, heavy-duty rating.
2. Description: Manufacturer's standard direct-hung suspended grid system composed of main beams and cross furring .members that interlock to form a modular supporting network for application of gypsum board.
3. Protective Coating - Standard Applications: ASTM A 653/A 653M, not less than G40 (Z120), hot-dip galvanized coating, unless otherwise indicated.
4. Main Beams: Inverted T-shaped profile of single or double mounting flange; minimum 1 1/2 in (38 mm) profile height with top bulb and minimum 1-3/8 in (35 mm) wide knurled mounting flange; factory punched for hanger wire, and to receive cross furring members.
5. Cross Furring Members:

   a. Tees: Inverted T-shaped profile of single or double mounting flange; 1-1/2 in (38 mm) profile height with top bulb and minimum 1-3/8 in (35 mm) wide knurled mounting flange; with ends formed for positive interlocking with main beam.
   b. Channels: Inverted hat shaped profile; minimum 7/8 in (21 mm) profile height and minimum 1-3/8 in (35 mm) wide knurled mounting flange; with ends formed for positive interlocking with main beam.

6. Wall Angle: Angle shaped profile with each leg not less than 1-1/4 in (32 mm).
7. Accessories: Specifically designed as an integral part of suspended grid system.
8. Available Manufacturers and Products:

   a. Armstrong World Industries Inc.; Drywall Grid System.
   b. Chicago Metallic Corporation; 650-C/670-C Fire-Rated Drywall Grid System.
   c. United States Gypsum Company (USG Interiors, Inc.); Drywall Suspension System.

B. Wire:

1. Material Quality Standard: ASTM A 641 / A 641M, Class 1, zinc-coated, soft annealed, mild steel wire.
2. Tie Wire Minimum Size: Single 0.0625 in (16 gage) (1.6 mm) diameter strand, or double 0.0475 in (18 gage) (1.2 mm) diameter strands. Preformed furring channel clips are acceptable.
3. Hanger Wire Minimum Size: 0.1620 in (8 gage) (4.12 mm) diameter.

C. Rod Hangers: ASTM A 1008 / A 1008M, 7/32 in (0.56 mm) diameter mild carbon steel rod, with primer painted finish.

D. Flat Hangers: ASTM A 1008 / A 1008M, 1 in by 3/16 in (25 mm by 5 mm) by length indicated or required, with primer painted finish.

E. Angle Hangers: ASTM A 36 / A 36M, rolled steel angle, 2 in by 2 in (50 mm by 50 mm), with primer painted finish.

2.5 METAL FRAMING COMPONENTS

A. Material Quality Standard: Provide components of sizes indicated but not less than that required to comply with ASTM C 754 for conditions indicated.

1. Sheet Steel: ASTM C 645 for metal.
2. Protective Coating - Standard Applications: ASTM A 653/A 653M, not less than G40 (Z120), hot-dip galvanized coating, unless otherwise indicated.

B. Metal Studs and Floor Track (Runners):

1. Standard Metal Framing Components for Typical Partitions:

a. Stud Description: C-shaped members formed from galvanized sheet steel with 1 1/4 in (32 mm) flange edges bent back 90 degrees and doubled over to form 13/64 in (5 mm) wide minimum return lip; of web depth indicated on Drawings and uncoated base metal thickness indicated in "Metal Framing Schedule" at end of this Section; with web punchouts.

1) Alternative Jamb Stud Members - Contractor's Option: "Heavy Duty" or "King" studs; C-shaped members formed from galvanized sheet steel with 3 in (75 mm) flange width; of web depth indicated on Drawings and uncoated base metal thickness indicated in "Metal Framing Schedule" at end of this Section.

b. Track (Runner) Description: U-shaped members formed from galvanized sheet steel with depth compatible with studs and flange dimension indicated to hold studs by friction; of same web size and uncoated base metal thickness as studs.

1) Floor Track (Runner): 1-1/4in (32 mm).
2) Top of Wall Track (Runner): 3 in (75 mm).

c. Optional Equivalent Products - Deformed Surface Studs and Tracks (Runners):

1) Evaluation Criteria: Product test reports and certifications from independent testing agency indicating products comply with requirements.
2) Material Quality Standard: ASTM A 1003 / A 1003M sheet steel with galvanized coating.
3) Stud Description: C-shaped members formed from dimpled surface galvanized sheet steel with 1-1/4 in (32 mm) flange edges bent back 90 degrees and bent again to form 3/16 in (5 mm) wide minimum return lip; of web depth indicated on Drawings and uncoated base metal thickness indicated in "Metal Framing Schedule" at end of this Section; with web punchouts.
4) Track (Runner) Description: U-shaped members formed from dimpled surface galvanized sheet steel with depth compatible with studs and flange dimension indicated to hold studs by friction; of same web size and uncoated base metal thickness as studs.
5) Available Manufacturers and Products:

a) Clark Western Building Systems; UltraSTEEL.
b) Dietrich Industries, Inc.; UltraSTEEL.

2. Metal Framing for Shaftwall Partitions:

   a. Stud Description: C-H, double E, C-T, or I-shaped members formed from galvanized sheet steel; of web depth indicated on Drawings and uncoated base metal thickness indicated in "Metal Framing Schedule" at end of this Section; with web punchouts.
   b. Track (Runner) and Jamb Description: J-shaped track or jamb members formed from galvanized sheet steel with depth compatible with studs and flange dimension indicated to hold studs by friction; of same web size and uncoated base metal thickness as studs.

3. Conversion of Gage to Minimum Thickness for Metal Framing: When metal framing is indicated to be of a specific gage thickness, following shall be uncoated base metal thickness according to SSMAs "Product Technical Information", 2000:

   a. 25 Gage: 0.0188 in (0.48 mm) design thickness; 18 mils minimum thickness.
   b. 22 Gage: 0.0283 in (0.72 mm) design thickness; 27 mils minimum thickness.
   c. 20 Gage Drywall: 0.0312 in (0.79 mm) design thickness; 30 mils minimum thickness.
   d. 20 Gage Structural: 0.0346 in (0.88 mm) design thickness; 33 mils minimum thickness.
   e. 18 Gage: 0.0451 in (1.15 mm) design thickness; 43 mils minimum thickness.
   f. 16 Gage: 0.0566 in (1.44 mm) design thickness; 54 mils minimum thickness.
   g. 14 Gage: 0.0713 in (1.81 mm) design thickness; 68 mils minimum thickness.
   h. 12 Gage: 0.1017 in (2.58 mm) design thickness; 97 mils minimum thickness.

4. Minimum thickness represents 95 percent of design thickness and is minimum acceptable thickness of material for Work.

C. Flat Straps and Back-Up Plates: Galvanized sheet steel for blocking and bracing in length and width indicated, of same uncoated base metal thickness as adjacent metal studs.

D. Bridging:

1. Channel: U-shaped members formed from galvanized sheet steel not less than 0.0566 in (16 gage) (1.44 mm) minimum uncoated base metal thickness, with 1/2 in (12 mm) flanges and depth fitting stud punchouts.
2. Clip Angle: 1-1/2 in by 1-1/2 in (38 mm by 38 mm) L-shaped members formed from galvanized sheet steel not less than 0.0713 in (14 gage) (1.81 mm) uncoated base metal thickness.

E. Rigid Furring Channels: Hat-shaped members formed from galvanized sheet steel not less than 0.0312 in (20 gage) (0.78 mm) minimum uncoated base metal thickness; 7/8 in (21 mm) depth and minimum 1-3/8 in (35 mm) wide knurled mounting flange.

F. Framing Accessories: Framing manufacturers standard connectors, bracings, brackets, clips, gussets, and other framing devices as required by conditions, formed from galvanized sheet steel complying with requirements of main support system.

G. Available Manufacturers:

1. Building Products Division of Consolidated Fabricators Corp.
2. California Expanded Metal Products Co. (CEMCO).
3. Clark Western Building Systems.
4. Dietrich Industries, Inc.
5. Marino Ware; Division of Ware Industries.
6. Scafco Corp.

2.6 PRE-ENGINEERED METAL FRAMING COMPONENTS

A. Deflection and Firestop Track (Runner):

1. Description: Proprietary track (runner) formed from galvanized sheet steel manufactured to accommodate movement of building structure without transferring stress to partition (to prevent cracking of gypsum board resulting from deflection of building structure above) while maintaining continuity of fire resistance rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
2. Available Manufacturers:

    a. Metal Stud Framing Manufacturer.
    b. Fire Trak Corp.
    c. The Steel Network.

B. Headers:

1. Description: Proprietary header assembly formed from galvanized sheet steel manufactured to bear partition load above openings without transferring stress to partition (to prevent cracking of gypsum board); in thickness not less than indicated for studs and in width to accommodate depth of studs.
2. Available Manufacturers:

    a. Metal Stud Framing Manufacturer.
    b. Brady Construction Innovations, Inc.

2.7 GYPSUM BOARD PRODUCTS

A. Sizes: Maximum lengths and widths available that will minimize short edge-to-short edge butt joints and to correspond to support system indicated.

B. Typical Paper-Faced Gypsum Board Products:

1. Paper-Faced Type X Gypsum Board:

    a. Material Quality Standard: ASTM C 1396 / C 1396M, Type X.
    b. Description: Noncombustible fire resistant gypsum core with paper surfacing on face, back, and long edges; tapered long edges; 5/8 in (15 mm) thick.
    c. Available Manufacturers and Products:

        1) CertainTeed Corporation; ProRoc Type X Gypsum Board.
        2) Georgia-Pacific Gypsum LLC; ToughRock Fireguard Gypsum Board.
        3) National Gypsum Properties, LLC; Gold Bond Fire-Shield Gypsum board.
        4) Temple-Inland Inc.; GypsumBoard Fire-Resistant Panels.
        5) United States Gypsum Company (USG); Sheetrock Firecode Core.

2. Paper-Faced Type C Gypsum Board:

    a. Material Quality Standard: ASTM C 1396 / C 1396M, Type X.
    b. Description: Noncombustible fire resistant gypsum core, with additives to enhance fire resistance, with paper surfacing on face, back, and long edges; tapered long edges; 5/8 in (15 mm) thick.

c. Available Manufacturers and Products:

1) CertainTeed Corporation; ProRoc Type C Gypsum Board.
2) Georgia-Pacific Gypsum LLC; ToughRock Fireguard C Gypsum Board.
3) National Gypsum Properties LLC; Gold Bond Fire-Shield C Gypsum board.
4) Temple-Inland Inc.; GypsumBoard Fire-Resistant Panels - Type TG-C.
5) United States Gypsum Company (USG); Sheetrock Firecode C Core Gypsum Panels.

3. Paper-Faced Acoustically Enhanced Gypsum Board:

a. Description: Noncombustible gypsum core, with polymer sound dampening sheet in center, with paper surfacing on face, back and long edges; tapered long edges; 5/8 in (15 mm) thick.
b. Available Manufacturers and Products:

1) National Gypsum Properties LLC; Gold Bond SoundBreak Gypsum Board.
2) Quiet Solutions; 525, 527, and 528 depending on application.
3) Temple-Inland Inc.; ComfortGuard Sound-Deadening Gypsum Board.

C. Moisture-Resistant Gypsum Board Products:

1. Moisture-Resistant Paper-Faced Gypsum Board:

a. Material Quality Standard: ASTM C 1396 / C 1396M, Type X.
b. Description: Enhanced moisture-resistant, noncombustible gypsum core, with moisture-resistant paper surfacing on face, back and long edges; tapered long edges; score of 10 according to ASTM D 3273; 5/8 in (15 mm) thick.
c. Available Manufacturers and Products:

1) CertainTeed Corporation; ProRoc Moisture and Mold Resistant Type X Gypsum Board.
2) National Gypsum Properties LLC; Gold Bond XP Gypsum Board.
3) Temple-Inland Inc.; ComfortGuard Water- and Mold-Resistant Gypsum Board.
4) United States Gypsum Company (USG); Sheetrock Mold Tough Firecode Gypsum Board.

2. Moisture-Resistant Paperless Glass-Mat Gypsum Board:

a. Material Quality Standard: ASTM C 1177 / C 1177M.
b. Description: Enhanced moisture-resistant, noncombustible gypsum core with inorganic, embedded fiberglass mat on both faces; square edges; score or 10 according to ASTM D 3273; 5/8 in (15 mm) thick.
c. Basis of Design: Georgia-Pacific Gypsum LLC; DensArmor Plus Fireguard Interior Guard.

3. Moisture-Resistant Paper-Faced Shaft-Liner Gypsum Board:

a. Material Quality Standard: ASTM C 1396/C 1396M, Type X.
b. Description: Enhanced moisture-resistant, noncombustible gypsum core with moisture-resistant paper surfacing on face, back and long edges; tapered long edges; score of 10 according to ASTM D 3273; 1 in (25 mm) thick.
c. Acceptable Manufacturers and Products:

1) National Gypsum Co.; Gold Bond 1" Fire-Shield Shaftliner XP.

2) USG Corp.; Sheetrock Gypsum Liner Panels Mold Tough.

4. Moisture-Resistant Paperless Glass-Mat Shaft-Liner Gypsum Board:

a. Material Quality Standard: ASTM C 1396 / C 1396M.
b. Description: Enhanced moisture-resistant, noncombustible gypsum core with inorganic, embedded fiberglass mat on both faces, double bevel long edges; score of 10 according to ASTM D 3273; 1 in (25 mm) thick.
c. Available Manufacturers and Products:

1) Georgia-Pacific Gypsum LLC; DensGlass Ultra Shaftliner.
2) Temple-Inland Inc.; GreenGlass Shaftliner.

5. Moisture-Resistant Coated Glass-Mat Gypsum Board Products:

a. Material Quality Standard: ASTM C 1178 / C 1178M.
b. Description: Enhanced moisture-resistant, noncombustible, gypsum core with inorganic, embedded fiberglass mat on both sides; outside face coated with heat-cured copolymer water-resistant coating; square edges; score or 10 according to ASTM D 3273; 5/8 in (15 mm) thick.
c. Basis of Design: Georgia-Pacific Gypsum LLC; DensShield Tile Backer.

2.8 TRIM ACCESSORIES

A. Typical Drywall Trim Accessories:

1. Material Quality Standard: ASTM C 1047.
2. Description: Trim profile fabricated of galvanized steel sheet; of size suitable for gypsum board thickness; with recessed, perforated flange formed to receive joint compound.
3. Trim Products:

a. Cornerbead:

1) Purpose: For protecting outside (external) corners.
2) Basis of Design: United States Gypsum Company (USG); Dur-A-Bead Corner Bead, 103.

b. LC-Bead (J-Bead):

1) Purpose: For protecting exposed edges of gypsum board where back flange can be used.
2) Basis of Design: United States Gypsum Company (USG); J-Trim, 200-A.

c. L-Bead:

1) Purpose: For protecting exposed edges of gypsum board where back flange cannot be used.
2) Basis of Design: United States Gypsum Company (USG); L-Trim, 200-B.

d. J-Stop:

1) Purpose: For protecting edges of gypsum board that does not require finishing.
2) Basis of Design: United States Gypsum Company (USG); J-Stop, 402.

e. Control Joint:

1) Description: One-piece trim formed with V-shaped slot, with removable strip covering slot opening.
2) Purpose: For conditions requiring expansion and contraction stresses of large areas of gypsum board to be relieved.
3) Basis of Design: United States Gypsum Company (USG); Control Joint, 093.

f. Other Trim or Special Shapes: Products as required by condition.

4. Other Available Manufacturers:

a. Dietrich Industries, Inc.; Unimast.
b. Fry Reglet Architectural Metals.
c. Marino Ware; Division of Ware Industries.
d. Niles Building Products Co.
e. Superior Metal Trim; Division of Delta Star, Inc.

B. Accent Trim Accessories:

1. Description: Extruded aluminum accessories of profiles and dimensions indicated of alloy and temper with not less than strength and durability properties of ASTM B 221, alloy 6063-T5.
2. Basis of Design:

a. Aluminum Trim Accessory Type 1:

1) Manufacturer: Fry Reglet.
2) Product: Contemporary Reveal – CDRM-625-75.
3) Reveal Dimension: 5/8 inch reveal depth x 3/4 inch reveal width.
4) Finish: Clear anodized.

b. Aluminum Trim Accessory Type 2:

1) Manufacturer: Fry Reglet.
2) Product: Channel Screed – PCS-75-75.
3) Reveal Dimension: 3/4 inch reveal depth x 3/4 inch reveal width.
4) Finish: Clear anodized.

c. Aluminum Trim Accessory Type 3:

1) Manufacturer: Fry Reglet.
2) Product: 'T' Reveal Molding – TRM-75-75.
3) Reveal Dimension: 3/4 inch reveal depth x 3/4 inch reveal width.
4) Finish: Clear anodized.

3. Available Manufacturers:

a. Fry Reglet Architectural Metals.
b. Gordon, Inc.
c. Pittcon Industries.

2.9 FASTENERS

A. Limitations: Nails and staples are not permitted.

B. Metal Framing Screws: Screw fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten metal framing and furring members securely to substrates involved; complying with recommendations of gypsum board manufacturers for applications indicated.

C. Gypsum Board Screws:

1. Material Quality Standards:

a. Metal Framing Members less than 0.03 in (0.75 mm) Thick: ASTM C 1002, Type S.
b. Metal Framing Members from 0.033 in to 0.112 in (0.79 mm to 2.9 mm) Thick: ASTM C 954, Type S-12.

2. Product Description - Standard Applications: Bugle head, self-drilling, self-tapping, steel screws with Phillips-head recess of size, holding power, and other properties recommended by respective gypsum board manufacturer; minimum 1 in (25 mm) long; with corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
3. Product Description - High Moisture / Humidity Applications: Bugle head, self-drilling, self-tapping, stainless steel screws with Phillips-head recess of size, holding power, and other properties recommended by respective gypsum board manufacturer; for use at high moisture areas such as Kitchens, Showers and Tub Enclosures, Saunas, Steam Rooms, and Pool Enclosures.

D. Miscellaneous Fasteners: For conditions not indicated, fasteners shall be type, finish, size, and holding power recommended by respective gypsum board manufacturer and conditions.

2.10 JOINT TREATMENT MATERIALS

A. Material Quality Standard: ASTM C 475 / C 475M.

B. Joint Tape:

1. Paper Tape: Nominal 2 in (50 mm) wide cross-fibered paper tape with finish suitable for bonding, creased in center for easy folding, and compatible with joint compound.
2. Mesh Tape: Nominal 2 in (50 mm) wide self-adhering 10-by-10 fiberglass mesh tape.

C. Joint Compound:

1. Setting-Type: Job-mixed powder for mixing with water, chemical-hardening compound; includes taping types.
2. Drying-Type: Ready-mixed or job-mixed powder for mixing with water, air-drying, vinyl based compounds; includes taping, topping, and all-purpose types.

2.11 INTERIOR SURFACING COMPOUNDS

A. Level 5 Primer and Surfacer: Latex based compound containing polyvinyl acetate (PVA) polymer that can be spray or roller applied to change a Level 4 finish to a Level 5 finish.

1. Available Manufacturers and Products:

a. CertainTeed Corporation; ProRoc Level V Wall and Ceiling Primer/Surfacer.
b. United States Gypsum Company (USG); Sheetrock Brand Tuff-Hide Primer-Surfacer.

2.12 RELATED MATERIALS

A. General: Provide auxiliary materials for gypsum board construction that comply with referenced quality standards and recommendations of gypsum board manufacturer.

B. Firestopping Products at Penetrations: As specified in Division 07 Section "Through-Penetration Firestopping".

C. Fiberglass Sound Attenuation Blankets:

1. Material Quality Standard: ASTM C 665, Type I.
2. Description: Unfaced blankets produced by bonding inorganic glass fibers with a thermosetting binder; free of formaldehyde.
3. Surface Burning Characteristics: According to ASTM E 84/NFPA 255/UL 723:

   a. Flame Spread: Class A – no greater than 25.
   b. Smoke Developed: No greater than 50.

4. Thickness: Not less than 2-1/2 in (62 mm), unless otherwise indicated.
5. Basis of Design: Johns Manville; Sound Control Batts, Formaldehyde Free.

D. Acoustical Sealant for Non-Fire Resistance Rated Joints:

1. Description: Nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 that is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90.
2. Available Manufacturers and Products:

   a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
   b. United States Gypsum Company (USG); Sheetrock Acoustical Sealant.

E. Fire-Resistance Rated and Acoustical Putty Pads:

1. Product Quality Standard: UL 1479.
2. Description: Fire-rated, non-hardening, moldable, intumescent compound formed into sheets designed to seal penetrations, construction gaps, and around electrical boxes against spread of fire, smoke, and toxic gases.
3. Available Manufacturers and Products:

   a. Grace Construction Products; Flamesafe FSP 1077 Putty Pads.
   b. Hilti; CP 617 Intumescent Acoustic Putty Pads.
   c. KnaufDrywall; Putty Pads.
   d. Specified Technologies, Inc; Series SSP Putty Pads.
   e. Tremco; TREMstop Electrical Box Insert.
   f. 3M; Fire Barrier Moldable Putty+Pads.

F. One-Piece Barrier Box:

1. Description: Rigid reinforced polyethylene box designed to fit around electrical boxes to prevent leaks of air and vapor.
2. Basis of Design: Lessco Air-Vapor Barrier Box.

G. Fire Resistive Sealants: Intumescent elastomeric sealant as specified in Division 07 Section "Fire-Resistive Joint Systems".

H. Sealants: Sealant as specified in Division 07 Section "Joint Sealants".

I. Isolation Strips: Adhesive-backed, closed cell neoprene or vinyl foam strips that allow fastener penetration with foam displacement, size as indicated, compressed 50 percent.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective Manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.
4. Gypsum Association GA 216.
5. United States Gypsum Company (USG); Gypsum Construction Handbook, if no other installation quality standard applies to condition.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Suspended Gypsum Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hanger wires at spacing required to support ceilings and that hangers will develop their full strength.

C. Coordination with Sprayed Fire-Resistance Materials:

1. Pre-Application Coordination: Before sprayed fire-resistance materials are applied, attach Z shaped clips and offset mounting plates to structural steel members with powder actuated fasteners, leaving portion of flange exposed outside of sprayed fire-resistive materials to attach head of wall track for gypsum board assembly.
2. Post-Application Coordination: After sprayed fire-resistive materials are applied, remove materials only to extent necessary for installation of gypsum board assemblies, attach Z shaped clips and offset mounting plates to structural steel members with powder actuated fasteners, leaving portion of flange exposed outside of sprayed fire-resistive materials to attach head of wall track for gypsum board assembly, and patch with fire-resistive material specified in Division 07 Section "Sprayed Fire-Resistive Materials" that is required to obtain fire-resistance rating indicated.

3.4 INSTALLATION OF GYPSUM BOARD ASSEMBLIES

A. Resistance Rated Partitions: Construct fire resistance rated, smoke resistance rated, and sound resistance rated partitions according to respective assembly test reports. Ensure every material used within an assembly shall comply with manufacturers listed and product qualities indicated in respective assembly test report.

B. Penetrations and Openings: Construct within gypsum board assemblies work as required to properly form penetration or opening to receive firestopping materials specified in following Sections:

1. Division 07 Section "Through-Penetration Firestopping".
2. Division 07 Section "Fire-Resistive Joint Systems".

C. Control Joints: Install control joints at locations indicated on Drawings, in specific locations approved by Architect for visual effect and according to the following:

1. Spaced not more than 30 feet in either direction for uninterrupted straight planes of ceilings and walls.
2. Where different substrates occur at ceilings and walls.
3. Where control joints occur in substrates at ceilings and walls.
4. Where ceilings and walls abut inside face of exterior walls.
5. Where L, U, or T shaped ceiling configurations are joined.
6. Where less than ceiling height door frames occur; extend control joints from top of frame up to ceiling at corner of hinge side of door.
7. Where less than ceiling height window frames occur; extend control joints from top of frame up to ceiling and from bottom of frame to floor at both corners.

D. Isolation from Building Structure: Isolate gypsum board assemblies from building structure to prevent transfer of loading imposed by structural movement.

1. Provide isolation joints as indicated or required by installation quality standards.
2. Isolate ceiling assemblies abutting or penetrated by building structure.
3. Isolate partition framing and wall furring abutting or penetrated by building structure, except at floor.

E. Building Expansion Joints: Avoid bridging building expansion joints with metal framing or furring members; frame both sides of joints independently with framing or furring members, coordinating with building expansion joint products specified in Division 07 Section "Expansion Control".

F. Fire-Resistance Rated and Acoustical Putty Pads: Hand apply pads to surfaces indicated, packing tightly into gaps and openings, in such a manner that pad will remain secured to surface; pinch pleat excess material together to close gaps.

G. One-Piece Barrier Box: Install in accordance with manufacturer's recommendations as indicated on the Drawings.

H. Supplemental Accessories: Install supplementary framing, blocking, reinforcing, and bracing in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, hand rails, furnishings, or similar construction. Comply with details indicated and recommendations of installation quality standards or manufacturer.

3.5 INSTALLING SUSPENDED GRID SYSTEM FOR INTERIOR CEILINGS

A. Installation Quality Standard: In addition to standards listed elsewhere, perform suspended ceiling work according to following, unless otherwise specified in this Section:

1. ASTM C 635 and ASTM C 636 / C 636M.
2. CISCA – "Recommendations for Direct-Hung Acoustical Tile and Lay-In Ceilings – Seismic Zones 0 – 2", except as may be modified by building code.

B. Pattern: Lay out spaces and arrange suspension system in a regular pattern, parallel or perpendicular to surrounding walls.

C. Hangers for Ceiling System: Suspend hangers from building structural members and as follows:

1. Install hangers plumb and free from contact with mechanical and electrical equipment, insulation or other objects within ceiling plenum that are not part of supporting structural frame or ceiling suspension system. Within limitations allowed by installation quality standards, splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers required to support suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by installation quality standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
4. Secure the appropriate hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Install metal framing components for suspended ceilings so that members are level to within 1/8 in in 12 ft (3 mm in 3.6 m) as measured both lengthwise on each member and transversely between parallel members.
6. Attach hangers to structural members.
7. Do not connect or suspend any ceiling components from ducts, pipes or conduit.

D. Perimeters: Using gypsum board screws through gypsum board into metal studs, attach perimeter wall angle where suspended grid system meets vertical surfaces unless otherwise indicated; cut main beams and cross furring members to fit into wall angle.

E. Main Beams:

1. Suspend main beams spaced 48 in (1200 mm) on center from structure with wire hangers spaced not greater than 48 in (1200 mm) on center.
2. Install main beams level within 1/8 in in 12 ft (3 mm in 3.6 m) with hanger wire taut and tightly wrapped to prevent vertical movement or rotation.
3. Do not make local kinks or bends in hanger wires as a means of leveling.

F. Cross Furring Members:

1. Install cross furring members at right angles to main beams, spaced as required and join to main beams with positive interlock.
2. Install cross furring members to within 1/32 in (0.8 mm) of their required location and within 0.015 in (0.38 mm) of same horizontal plane as main beam, and never below continuous member.

3. Install additional cross furring members at right angles to beams and cross furring members to support ends of recessed light fixtures, diffusers or grilles.

G. Concentrated Load Conditions: Provide additional hanger wires at each corner of recessed light fixtures and other concentrated load conditions to prevent excess deflection.

H. Seismic Conditions: Install bracing wires, compression struts, and other components as required by installation quality standard.

3.6 INSTALLING METAL FRAMING COMPONENTS

A. Priority: Assemble various assemblies giving priority to partitions with higher rating; extend partition with higher rating intact through partition with lower rating.

B. Joinery and Connections: Install various metal framing components according to details indicated; for situations and conditions not indicated, comply with installation quality standards and with respective manufacturer's recommendations.

C. General Requirements: Construct partition framing of studs, tracks, and headers using screws of number and spacing required.

1. Install studs of uncoated base metal thickness as determined by Metal Framing Schedule at end of this Section.
2. Extend partition framing full height to underside of structure above, except where partitions are indicated to terminate at, or immediately above, suspended ceilings.
3. Continue framing over door frames and openings to provide support for gypsum board.
4. Space studs as indicated on Metal Framing Schedule at end of this section.
5. Cut studs 1 in (25 mm) short of full height to provide deflection relief at head of wall conditions.
6. Install studs so that flanges point in same direction.
7. Attach with screws through each stud flange and track (runner) flange.
8. For fire resistance rated, smoke resistance rated, and sound resistance rated assemblies that are required to extend to underside of structure above to obtain ratings, install framing around structural and other members extending below floor slabs or roof decks, as needed to support gypsum board closures and make partitions continuous from floor to underside of structure above.
9. Do not lap studs.
10. At intersections and corners, locate studs no more than 2 in (50 mm) from partition intersections and corners and secure with screws through both flanges of studs and tracks.
11. Install horizontal bridging at 48 in (1200 mm) on centers vertically where indicated or required by installation quality standard.

D. Metal Track (Runner) Requirements:

1. Floors: Install tracks (runners) using appropriate fasteners spaced not more than 16 in (400 mm) on centers.
2. Head of Wall: Where indicated, install proprietary deflection and firestop track (runner) using appropriate fasteners for the substrate and installation conditions.

E. Support for Wall Mounted Accessories or Equipment: Install back-up plate or track (runner) turned on its side, using screws as indicated or as required, to studs to properly transfer accessory or equipment load to metal framing.

F. Openings: Frame single door, double door, above ceiling openings, and below ceiling openings using studs, tracks (runners), clip angles, and headers.

1. Install 2 studs on each side of each opening in configuration indicated, including strap plates; extend from floor to underside of structure above; do not cut these studs under any circumstances.
2. Construct header of appropriate configuration for type of opening to be spanned and secure with clip angles; include sound attenuation blankets within cavity when partition is scheduled to have a sound resistance rating.
3. Install short intermediate studs 16 in (400 mm) on center between top track and header.
4. At partitions indicated to terminate immediately above ceiling, install diagonal bracing at not less than spacing as indicated.

G. Supplementary Framing: Install around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by metal framing.

H. Penetrations: Maintain fire-resistance rating of assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

I. Chase Partitions:

1. Position double row of studs vertically in tracks (runners), opposite each other in pairs with flanges pointing in same direction.
2. Attach with screws through each stud flange and track (runner) flange.
3. Cross brace between rows of studs with one of following at 48 in (1200 mm) on center maximum vertically, attached to stud webs with screws:

    a. Coated glass-mat gypsum board, 12 in (300 mm) high by chase width.
    b. Metal studs turned on side, webs back-to-back.

J. Furred Walls:

1. Erect furring channels vertically, spaced 16 in (400 mm) on centers maximum, unless otherwise indicated.
2. Attach with appropriate fasteners, staggered on flanges.
3. Splice ends by nesting channels 8 in (200 mm) and securely anchoring to surface.
4. Miter 24 in (600 mm) long horizontal furring channels at corners and space 24 in (600 mm) on centers vertically.
5. Locate furring channels around perimeter of openings and secure to surfaces.

K. Control Joints:

1. Construct metal framing as indicated by installation quality standard to allow gypsum board control joints to function as intended.
2. For control joints located in fire resistance rated walls and partitions, construct of metal studs and mineral wool, full height of partition, according to assembly fire test reports.

L. Metal Framing Spanning Multiple Floors: Construct metal framing as required using longest length metal studs possible and attach to building structure with floor bypass clips.

M. Installation Tolerances: Install each metal stud metal framing and furring member so that fastening surfaces do not vary more than 1/8 in (3 mm) from plane formed by faces of framing members.

3.7 INSTALLING GYPSUM BOARD PRODUCTS

A. General Requirements:

1. Install type of gypsum board at location indicated by gypsum board schedule at end of this Section.
2. Do not install damaged gypsum boards.
3. Install gypsum boards with finishable face side out.
4. Butt gypsum boards together for a light contact at edges and ends with not more than 1/16 in (1.5 mm) of open space between panels.
5. Do not force gypsum boards into place.
6. Do not place tapered edges against cut edges or ends.

B. Isolation from Building Structure:

1. Isolate perimeter of walls and partitions at structural abutments, except floors.
2. Provide 1/4 in to 1/2 in (6 mm in 12 mm) wide spaces at these locations and trim edges with edge trim where edges of gypsum boards are exposed.
3. Seal joints between edges and abutting structural surfaces with acoustical sealant.

C. Single-Layer Board Assemblies:

1. At typical conditions, install gypsum board vertically (long dimension parallel to metal framing), to minimize short end-to-short end joints unless otherwise indicated or required by assembly fire test reports.
2. At interior of stairwells and other high walls, install gypsum boards horizontally, unless otherwise indicated or required by assembly fire test reports. Stagger abutting end joints not less than one framing member in alternate courses of gypsum boards.

D. Multi-Layer Board Assemblies: Apply base layers and face layers vertically (long dimension parallel to metal framing) with joints of base layers located over stud or furring member and face layer joints offset at least one stud space from base layer joints, unless otherwise indicated or required by assembly fire test reports. Stagger joints on opposite sides of partitions.

E. Ceiling Applications:

1. Apply gypsum board at right angles to main beams of suspension framing to minimize number of abutting end joints and avoid abutting end joints in central area of each ceiling.
2. Stagger abutting end joints of adjacent panels not less than one framing member.
3. Locate both edge or end joints of gypsum boards over intermediate supports or gypsum board back-blocking where metal framing is not present.

F. Typical Wall Applications:

1. Attach gypsum boards to metal studs so that leading edge or end of each board is attached to open (unsupported) edges of stud flanges first.
2. Stagger vertical joints on opposite sides of partitions.
3. Do not make joints other than control joints at corners of framed openings.
4. Attach gypsum boards to framing provided at doors, openings and cutouts. Install gypsum boards over door heads and extend to not less than one stud space - 16 in (400 mm) at each side of door or opening.
5. Cover both faces of metal framing with gypsum boards as indicated, except in chase walls that are braced internally.
6. Cut and fit gypsum boards around ducts, pipes, conduits, and other penetrations to form proper annular joint to receive firestopping.

7. Where partitions intersect open building structure members projecting below underside of floor slabs and roof decks, cut to fit profile formed by coffers, joists, beams, and other structural members; form proper annular joint to receive firestopping.
8. Support both edge and end joints of gypsum boards over metal framing.

G. Screw Attachments:

1. Attach gypsum board to metal framing with screw fasteners of type appropriate for gypsum board materials and installation conditions:

    a. Length shall be as required by condition and penetrating metal framing not less than 3/8 in (10 mm).
    b. Spacing shall be as recommended by installation quality standard, gypsum board manufacturer, or respective assembly test report.
    c. Use properly adjusted, positive-clutch electric power tool equipped with adjustable screw-depth head and a Phillips bit. Nails and staples are not permitted.

2. Drive screws to slightly dimple surface without breaking face paper, fracturing core, or stripping metal framing member around screw shank.
3. Space screws for non-fire resistance rated partitions and ceilings as recommended by installation quality standards.
4. Space screws for fire resistance rated partitions as required by assembly fire test reports.
5. Start field screwing near center and work towards edges.
6. Space screws not less than 3/8 in (10 mm) from gypsum boards edges.
7. Do not attach gypsum boards to top runner where wall or partition extends to building structure unless required by fire test reports.

H. Control Joints: Form control joints and expansion joints at locations indicated with required space between edges of adjoining gypsum boards.

I. Sound Attenuation Blankets: Install blankets within stud cavities set so that they are held in place by friction with metal studs; ensure blankets are secure within cavity and will not become displaced when second gypsum board side is closed.

J. Elevator Shaft Cants: Where gypsum board shaftwall assemblies cannot be positioned within 4 in (100 mm) of shaft face of structural beams, floor edges, and similar projections into shaft, install 5/8 in (15 mm) thick gypsum board cants covering tops of projections.

1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 in (600 mm) on centers with screws fastened to shaftwall framing.
2. Where steel framing is required to support gypsum board cants, install framing at 24 in (600 mm) on centers and extend studs from projection to shaftwall framing.

K. Sealant:

1. Comply with ASTM C 919 and manufacturers written recommendations for closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
2. Seal wall assemblies at perimeters, behind control joints, and at openings and penetrations with a continuous bead of sealant material according to following:

    a. Fire Resistance Sealant: Joints within fire resistance rated assemblies.
    b. Water Resistance Sealant: Joints within non-fire resistance rated assemblies exposed to possible water infiltration.

c. Acoustical Sealant: All other joints.

3.8 INSTALLING TRIM ACCESSORIES

A. General: Fasten trim accessories continuously according to accessory manufacturer's instructions using gypsum board screws; installation by clinch-on tool and staples not permitted.

B. Typical Trim Accessories:

1. Corner Beads: Install trim at external corners; use screws at each flange at 9 in (225 mm) on centers, opposite each other.
2. Edge Trim: Install trim where gypsum boards abut dissimilar material, and where edge of gypsum boards would otherwise be exposed; use screws at flange at 9 in (225 mm) on centers.

   a. LC-Bead (J-Bead): Install trim at exposed conditions where back flange can be attached to framing or supporting substrate before gypsum board installation.
   b. L-Bead: Install trim at exposed conditions where trim can only be installed after gypsum board installation.
   c. J-Stop: Install trim at concealed conditions where trim can only be installed after gypsum board installation.

3. Control Joints: Install trim at appropriate locations, ensuring gypsum board is not continuous over joint; use screws at each flange at 6 in (150 mm) on centers.

C. Accent Trim Accessories: Install at locations indicated, mitering corners and intersections to form tight, flush and uniform joints; use screws at each flange at 9 in (225 mm) on centers.

D. Trim Accessories at Exterior Windows: Install at locations indicated, mitering corners and intersections to form tight, flush and uniform joints; use screws at each flange at 9 in (225 mm) on centers.

3.9 FINISHING GYPSUM BOARD PRODUCTS

A. General: Treat board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare surfaces for decoration.

B. Joint Tape: Finish joints according to following:

1. Typical Paper-Faced Gypsum Board: Paper.
2. Moisture-Resistant Paper-Faced Gypsum Board: Mesh tape.
3. Cementitious Backer Units: Mesh tape.

C. Finishing: Finish boards and units to achieve specified level of finish as indicated in schedule at end of Section:

1. Typical Paper-Faced Gypsum Board: Either or combination of the following as recommended by manufacturer:

   a. Setting-type joint compounds.
   b. Drying-type joint compounds.

2. Moisture-Resistant Paper-Faced Gypsum Board: Setting-type joint compounds.
3. Cementitious Backer Unit: Setting-type joint compounds.

3.10 INTERIOR SURFACING COMPOUNDS

A. Skim Coat Finishing with Joint Compound:

1. Prepare concrete surfaces for applied finishes.

a. Grind ridges, fins, and high areas.
b. Remove form oil, efflorescence and greasy deposits.
c. Fill offsets, voids, bugholes, rock pockets level with surrounding surfaces with joint compound.
d. Apply as many coats of joint compound as necessary to eliminate cracks.
e. Verify that resulting concrete surface is uniformly smooth and free of irregularities.

2. Apply setting-type joint compound or Level 5 Primer and Surfacer over entire surface in thickness recommended by manufacturer.

B. Skim Coat Finishing with Concrete Surfacing Compound:

1. Prepare concrete surfaces for applied finishes.

a. Grind ridges, fins, and high areas.
b. Remove form oil, efflorescence and greasy deposits.
c. Fill offsets, voids, bugholes, rock pockets level with surrounding surfaces with concrete surfacing compound.
d. Apply as many coats of concrete surfacing compound as necessary to eliminate cracks.
e. Verify that resulting concrete surface is uniformly smooth and free of irregularities.

2. Apply Concrete Surfacing Compound over entire surface in thickness recommended by manufacturer.

3.11 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall inspect first day's Work and periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, and instructions. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

3.12 ADJUSTMENTS

A. Damaged Materials: Stored or installed paper-faced gypsum board materials not specifically manufactured as "moisture-resistant products" shall be classified as damaged, defective, and nonconforming Work if they have been exposed to wetness or dampness at any time prior to Material Completion or if they exhibit evidence of active or dormant mold or mildew. Damaged materials and assemblies shall be replaced with new and dry materials and assemblies.

3.13 PROTECTION

A. Procedures: Protect products and systems from damage during installation and remainder of construction period according to manufacturer's instructions.

3.14 METAL FRAMING SCHEDULE

A. Metal Stud Framing Schedule:

1. Stud Depth: As indicated on Drawings.
2. Spacing: Maximum 16 in (400 mm) on centers, unless otherwise indicated, or as required to comply with respective assembly test report.
3. Minimum Performance Requirements - unless otherwise indicated:

    a. Typical Partitions: L/240 at 5 lb/sq ft (239 Pa) lateral load
    b. Partitions with Tile Facing: L/360 at 7.5 lb/sq ft (359 Pa) lateral load.
    c. Partitions with Interior Stone Facing: L/720 at 10 lb/sq ft (479 Pa) lateral load.

4. Minimum Uncoated Base Metal Thickness:

    a. Typical Gypsum Board Assemblies: As determined by manufacturer's limiting height engineering data unless otherwise indicated.

        1) 25 Gage or 25 Gage Equivalent Studs: Not acceptable.
        2) 22 Gage Studs: Typical partitions unless otherwise indicated.
        3) 20 Gage or 20 Gage Equivalent Studs:

            a) Partitions supporting ceramic or stone tile.
            b) Partitions with gypsum board on one side only.
            c) At door jambs.
            d) Partitions supporting wall hung cabinets or shelving.

        4) 16 Gage Studs: Typical at partitions supporting stone facing unless otherwise indicated.

    b. Gypsum Board Assemblies required to Withstand Seismic Loads: As required by delegated engineering professional but not less than minimum uncoated base metal thickness indicated above.

3.15 GYPSUM BOARD SCHEDULE

A. Gypsum Board Schedule, General: Install the designated gypsum board product based on exposure classification to water and / or moisture and applied finish system as follows, unless otherwise indicated or scheduled on the Drawings.

B. No Exposure: Surfaces not normally exposed to water and / or moisture sources including but not limited to the following:

1. Typical walls and ceilings.

    a. Paint and Wall Coverings Only: Typical paper-faced gypsum board.

2. Horizontal fire-rated assemblies and ceilings:

    a. Paint Only: Paper-faced Type C gypsum board.

3. Walls in acoustical barriers as indicated in the Drawings.

    a. Paint and Wall Coverings Only: Paper-faced acoustically enhanced gypsum board.

4. Shaft-Side Face of Shaft-Liner Assemblies:

    a. No Finish Required: Moisture-resistant paper-faced shaft-liner gypsum board or moisture resistant paperless glass mat shaft-liner gypsum board.

C. Incidental Exposure: Surfaces immediately adjacent to water and / or moisture sources including, but not limited to, the following locations:

1. Top of walls above ceilings adjacent to mechanical equipment in corridors.
2. Walls and ceilings in mechanical equipment rooms and janitor closets.
3. Walls within 24 inches of centerline of drinking fountains, isolated wall-hung lavatories, and countertop sinks and other similar water sources.
4. Interior face of exterior walls.
5. Acceptable gypsum board products for the above listed conditions:

    a. Paint and Wall Coverings: Moisture-resistant paper-faced or moisture-resistant paperless glass-mat gypsum board.
    b. Tile and Adhered Sheet/Panel Coverings: Moisture-resistant coated-glass-mat gypsum board.

D. Direct Exposure: Surfaces normally soaked, saturated, or regularly and frequently exposed to water and / or moisture including, but not limited to, the following locations:

1. Walls and ceilings in toilet rooms and bathrooms including bathtubs and showers:

    a. Paint and Wall Coverings: Moisture-resistant paper-faced or moisture-resistant paperless glass-mat gypsum board.
    b. Tile and Adhered Sheet/Panel Coverings: Moisture-resistant coated-glass-mat gypsum board.

3.16 GYPSUM BOARD FINISHING SCHEDULE

A. Gypsum Board Finishing Schedule, General: Finish panels to Levels of Finish indicated below. Apply joint tape over panel joints, except those with trim having flanges not intended for tape. Sand between coats and after last coat to produce a surface free of defects and ready for applied finish system.

B. Preparation: Apply joint compound at open joints, panel edges, and damaged surface areas.

C. Level 1: At following locations, embed tape at joints in joint compound unless a higher level of finish is required for fire resistance rated assemblies:

1. Ceiling plenum areas above ceilings.
2. Concealed areas.
3. Substrate for interior stone facing.
4. Substrate for interior woodwork.
5. Unfinished areas designated for future expansion.

D. Level 2: At following locations, embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges:

1. Substrate for tiling.

E. Level 3: At following locations, embed tape and apply separate first and second coats of joint compound to tape, fasteners, and trim flanges:

1. Areas to receive paint with flat sheen or medium/heavy texture.
2. Mechanical, electrical, data and elevator equipment rooms.
3. Stair towers.

F. Level 4: At following locations, embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges:

1. Areas to receive paint with eggshell/satin sheen or light texture.
2. Areas to receive Type II vinyl wall coverings.
3. Areas to receive fabric wall coverings.

G. Level 5: At following locations, embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound or Level 5 Primer and Surfacer over entire surface:

1. Areas to receive paint with semi-gloss or gloss sheen.
2. Areas to receive lightweight Type I vinyl wall coverings.
3. Areas to receive un-backed vinyl wall coverings.
4. Curved ceilings and partitions.
5. Areas where critical lighting conditions occur.
6. Other areas as indicated on the Drawings.

END OF SECTION

SECTION 09 3000

TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Modular tiles, membrane underlayments, setting materials, grouting materials, accessories, and supplementary items necessary for installation.

1.2 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. Module Size: Actual tile size plus joint width indicated.

C. Face Size: Actual tile size, excluding spacer lugs.

D. Ceramic (Mosaic) Tile: Tile formed by either the dust-pressed or plastic method, usually 1/4 in to 3/8 in (6 mm to 10 mm) thick, and having a facial area of less than 6 sq in (3900 mm²). Ceramic mosaic tile may be of either porcelain or natural clay composition and they may be either plain or with an abrasive mixture throughout.

E. Paver Tile: Glazed or unglazed porcelain or natural clay tile formed by dust-pressed method having a facial area of 6 sq in (3900 mm²) or more.

F. Porcelain Tile: A ceramic tile or paver tile that is generally made by the dust-pressed method of a composition resulting in a tile that is dense, impervious, fine grained, and smooth with sharply formed face.

G. Quarry Tile: Glazed or unglazed tile, made by extrusion process from natural clay or shale usually having a facial area of 6 sq in (3900 mm²) or more.

H. Wall Tile: A glazed tile with a body that is suitable for interior use and which is usually non-vitreous and is not required nor expected to withstand excessive impact or be subject to freezing and thawing conditions.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Include plans of rooms and elevations of walls showing tile and patterns; include sections showing underlayments, setting materials, and grouting materials.
2. Include details showing widths and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For each type of grout indicated. Include samples of accessories involving color selection.

D. Samples for Verification Purposes: Submit samples for each item listed below of size and construction indicated. Where products involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. Tile: Each type and composition of tile and for each color and finish required, at least 12 in (300 mm) square, mounted on rigid panel, and with grouted joints using product complying with specified requirements and in color approved for completed work.
2. Tile Trim and Accessories: Full-size units of each type and for each color required.
3. Metal Edge Strips: 6 in (150 mm) lengths of specified profile.

E. List of Materials for Layered Mock-Up for Construction Quality Purposes:

1. Product, material, and equipment names, model numbers, lot numbers, batch numbers, source of supply, and other information required to identify items used.
2. Receipt of list does not constitute acceptance of deviations from Contract Documents, unless such deviations are specifically approved by Architect in writing.

F. Master Grade Certificates: Submit for each shipment, type, and composition of tile, signed by tile manufacturer and installer.

G. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

H. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control" Article.

I. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

J. Qualification Data: For manufacturer and installer.

1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
2. Architect may waive submittal of qualification data for available manufacturers listed in this Section.

K. Maintenance Instructions: Include in operation and maintenance manual required by Division 01 Section "Closeout Requirements". Submit manufacturer's instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

L. Warranty: Sample of warranty.

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 10 years and with sufficient production capability, facilities, and personnel to produce required Work.

B. Installer Qualifications:

1. Experience: Installer with not less than 5 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project site during times specified Work is in progress that is experienced in installing systems similar to type and scope required for Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with minimum of 5 years experience in providing recommendations, observations, evaluations, and problem diagnostics. Sales representatives are not acceptable.

D. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

   a. Show typical components, attachments to building structure, and requirements of installation.
   b. Build mock-ups in a layered fashion omitting tile in particular areas to reveal underlayment membranes and setting bed installation including but not limited to the following:

      1) Tiled floor conditions at thin-set setting beds.
      2) Tiled floor conditions at medium-set setting beds.
      3) Movement joints at tiled floor conditions.
      4) Tiled wall conditions, including one interior corner.

2. Clean exposed faces of mock-up.
3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Protect accepted mock-up from the elements with weather-resistant membrane.
6. Obtain Architect's acceptance of mock-ups before starting fabrication.
7. Maintain mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.

8. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and accepted by Architect in writing.
9. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

a. Owner.
b. Architect.
c. Contractor, including superintendent.
d. Installer, including project manager and supervisor.
e. Manufacturer's qualified Technical Representative.
f. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Work requirements (Drawings, Specifications, and other Contract Documents).
c. Review required submittals, both completed and yet to be completed.
d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
e. Review required inspection, testing, certifying, and material usage accounting procedures.
f. Review environmental conditions and procedures for coping with unfavorable conditions.
g. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Install tile only when construction in room is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 WARRANTY

A. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Material Completion.

1.10 MAINTENANCE

A. Extra Materials: Furnish the following extra materials that match and are from same production runs as products installed, packaged with protective covering for storage and identified with labels describing contents:

1. Furnish quantity of full-size tile and trim units equal to 2 percent of amount installed, for each type, composition, color, pattern, and size.
2. Furnish quantity of grout equal to 2 percent of amount installed for each type, composition, and color indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Available Manufacturers and Products: Manufacturers offering products that may be incorporated into the Work include those listed.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality.

1. Selections: As indicated in Finish Legend.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1. Tile: For each tile, obtain of same color, finish, composition, and type, from same source and production run.
2. Setting and Grouting Materials: Obtain ingredients of uniform quality for each mortar and grout component from single manufacturer.

2.3 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements for Floor Tile:

1. Standards: Products and installation shall comply with Americans with Disabilities Act (ADA), ANSI A117.1, and state and local accessibility standards.
2. Floor Tile Slip Resistance: Products and installation shall result in a static coefficient of friction according to ASTM C 1028, without use of abrasive grain, as follows:

a. Level Floor Surface: Minimum 0.6.
b. Ramps: Minimum 0.8.
c. Steps: Minimum 0.6.

2.4 CERAMIC TILE PRODUCTS

A. Material Quality Standard: ANSI A137.1 "Specifications for Ceramic Tiling" for types, compositions, and grades of tiling indicated.

1. Furnish tiling complying with "Standard Grade" requirements, unless otherwise indicated.

B. Ceramic Tile, General: Thin ceramic surfacing unit made from clay, porcelain, or mixture of ceramic materials, glazed or unglazed, fired above red heat to temperature sufficient to produce specific physical properties and characteristics specified.

C. Factory Blending: For tile exhibiting color variations, blend tile in factory and package so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.

D. Mounting: Where factory-mounted tile is used, provide back- or edge-mounted tile assemblies as standard with manufacturer. Where tile is intended for installation in wet exposure areas, do not use factory mounted tile assemblies unless tile manufacturer states that this type of mounting is suitable for installation indicated.

E. Factory-Applied Temporary Protective Coating for Epoxy Grout Installations: Where recommended by tile and grout manufacturer, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating tile face surfaces with a continuous protective film that is easily removable without damaging tile or grout. Do not coat unexposed tile surfaces.

2.5 CRACK ISOLATION MEMBRANE UNDERLAYMENTS

A. General: Manufacturer's standard product that complies with ANSI A118.12 as selected from one of the following available options. Include primer, pre-fabricated corners, seaming cement, detail tape, sealant, and other standard accessory products required for application provided by membrane manufacturer.

B. Fluid-Applied Crack Isolation Membrane Underlayment: Not permitted or allowed within shower and bathtub areas.

1. Description: Manufacturer's proprietary system consisting of liquid applied component and synthetic fabric sheet reinforcement.
2. Available Manufacturers and Products:

a. Custom Building Products; Redgard.
b. Laticrete International Inc.; Laticrete 9235 Waterproof Membrane.
c. Laticrete International Inc.; Blue 92 Anti-Fracture Membrane.
d. Mapei Corp.; Mapelastic HPG.

C. Faced Chlorinated Polyethylene (CPE) Crack Isolation Membrane Underlayment:

1. Description: Non-plasticized, chlorinated polyethylene faced on both sides with high-strength, nonwoven polyester fabric; minimum 0.030 in (0.75 mm) nominal thickness.
2. Basis of Design: The Noble Company; NobleSeal CIS.

2.6 SETTING (MORTAR AND GROUT) MATERIALS

A. Material Quality Standards: ANSI A118 Series as indicated.

B. Medium-Set Latex-Portland Cement Mortar:

1. Material Quality Standard: ANSI A118.4, with the following physical properties:

a. Manufacturer's premium polymer modified Medium-set product; gray color. Use white color with light colored stone, translucent marble or light color grout as recommended by manufacturer.
b. Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
c. Non-sag capability.
d. Suitable for use in medium set mortar beds up to 3/4 in (19 mm) thick.

2. Available Manufacturers and Products - Floor Tiling:

a. Custom Building Products; Medium Bed Mortar.
b. Laticrete International, Inc.; Laticrete 255 MultiMax.
c. Mapei Corp.; Ultraflex LFT Mortar.

C. Thin-Set Latex-Portland Cement Mortar:

1. Material Quality Standard: ANSI A118.4, with the following physical properties:

a. Manufacturer's premium polymer modified thin-set product; gray color. Use white color with light colored stone, translucent marble or light color grout as recommended by manufacturer.
b. Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
c. Non-sag capability.
d. Suitable for use in thin set mortar beds up to 1/4 in (6 mm) thick.

2. Available Manufacturers and Products - Floor Tiling:

   a. Custom Building Products; Flexbond Fortified Thin-Set Mortar.
   b. Laticrete International, Inc.; Laticrete 254 Platinum Thin-Set Mortar.
   c. Mapei Corp.; Ultraflex 3 Mortar.

3. Available Manufacturers and Products - Wall Tiling:

   a. Custom Building Products; MagaLite Crack Prevention Mortar.
   b. Laticrete International, Inc.; Laticrete 255 MultiMax Multipurpose Thin-Set Mortar.
   c. Mapei Corp.; Ultralite Mortar.

D. Epoxy Mortar:

1. Material Quality Standard: ANSI A118.3, with the following physical properties:

   a. 100 percent solids.
   b. Chemical-resistant, water-cleanable, multiple component product.
   c. Resistant to intermittent exposure to temperatures of up to 212 deg F. (100 deg C.).
   d. Rated extra heavy service according to ASTM C 627.
   e. Will not stain when used for stone tile, and acceptable to stone supplier.

2. Available Manufacturers and Products:

   a. Custom Building Products; 100% Solids Epoxy Mortar.
   b. Laticrete International, Inc.; Latapoxy 300.
   c. Mapei Corp.; Kerapoxy 410.

E. Latex-Portland Cement Sanded Grout for Tile Joints Greater than 1/8 in (3 mm) Wide:

1. Material Quality Standard: ANSI A118.7, with following physical properties:

   a. Manufacturer's premium polymer modified sanded grout product.
   b. Integral antimicrobial product added during manufacturing to resist mold and mildew growth.

2. Available Manufacturers and Products:

   a. Custom Building Products; Prism Surecolor Grout.
   b. Laticrete International, Inc.; 1500 Sanded Grout with 1776 Grout Enhancer.
   c. Mapei Corp.; Ultracolor.

F. Latex-Portland Cement Unsanded Grout for Tile Joints Less than 1/8 in (3 mm) Wide:

1. Material Quality Standard: ANSI A118.7, with following physical properties:

   a. Manufacturer's premium polymer modified unsanded grout product.
   b. Integral antimicrobial product added during manufacturing to resist mold and mildew growth.

2. Available Manufacturers and Products:

   a. Custom Building Products; Prism Surecolor Grout.
   b. Laticrete International, Inc.; 1600 Unsanded Grout with 1776 Grout Enhancer.
   c. Mapei Corp.; Keracolor U.

G. Epoxy Grout:

1. Material Quality Standard: ANSI A118.3, with following physical properties:

a. 100 percent solids.
b. Chemical-resistant, water-cleanable, multiple component product.
c. Resistant to intermittent exposure to temperatures of up to 212 deg F. (100 deg C.).
d. Mold and mildew resistant.

2. Available Manufacturers and Products:

a. Custom Building Products; 100% Solids Epoxy Grout with Polyblend Sanded Grout.
b. Laticrete International, Inc.; Latapoxy 2000 Industrial Grout.
c. Mapei Corp.; Kerapoxy IEG.

2.7 ELASTOMERIC SEALANTS

A. Sealant Colors: Match color of adjacent grout unless otherwise indicated.

B. Wall Joint Sealant:

1. Material Quality Standard: ASTM C 920, Type S, Grade NS, Class 25, with following physical properties:

a. Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
b. Intended for sealing interior ceramic tile joints and other nonporous substrates.
c. Resistant to in-service exposures of high humidity and temperature extremes.

2. Description: One-part mildew-resistant silicone sealant.
3. Available Manufacturers and Products:

a. BASF Construction Chemicals; Sonneborn OmniPlus.
b. Dow Corning Corp.; 786.
c. Laticrete International, Inc.; Latasil.
d. Pecora Corp.; 898.
e. Tremco Inc.; Tremsil 200.

C. Floor Joint Sealant:

1. Material Quality Standard: ASTM C 920, Type S, Grade P, Class 25.
2. Description: One-part self-leveling polyurethane sealant.
3. Available Manufacturers and Products:

a. BASF Construction Chemicals; Sonneborn Sonolastic SL1.
b. Pecora Corp.; Urexpan NR-201.
c. Tremco Inc.; Tremflex S/L.

D. Chemical Resistant Floor Joint Sealant:

1. Description: Two-part self-leveling epoxy sealant.
2. Available Manufacturers and Products:

a. BASF Construction Chemicals; Sonneborn Epolith-P.
b. Euclid Chemical Co.; Euco 800.
c. L&M Construction Chemical Inc.; Epoflex SL.

E. Backer Rods:

1. Material Quality Standard: ASTM C 1330, Type B.
2. Description: Non-gassing (when punctured), bi-cellular polyethylene or polyolefin foam rod with a surface skin, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
3. Available Manufacturers and Products:

a. BASF Construction Chemicals; Sonneborn Soft Backer Rod.
b. Nomaco Inc.; Sof Rod.

F. Backer Tape: Bond-breaking polyethylene or other plastic tape, self-adhesive where applicable, recommended by sealant manufacturer for preventing sealant from adhering to back of joint where such adhesion would result in sealant failure.

2.8 RELATED MATERIALS

A. Cementitious Backer Units:

1. Material Quality Standard: ANSI A118.9 or ASTM C 1325.
2. Description: Cementitious panels composed of portland cement, aggregates, glass mesh on both faces, and manufacturer's proprietary ingredients; capable of remaining unaffected by prolonged exposure to water; 1/2 in (12 mm) thick.
3. Available Manufacturers and Products:

a. Custom Building Products; WonderBoard.
b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
c. National Gypsum Properties LLC; PermaBase Cement Board.
d. United States Gypsum Company (USG); DUROCK Interior Cement Board.

B. Cementitious Board Screws: Self-drilling, self-tapping, steel screws of type, material, size, corrosion resistance, holding power, and other properties recommended by respective cementitious board manufacturer.

C. Cementitious Underlayments: Trowelable or self-leveling as required by conditions; pre-mixed, latex-modified, Portland cement based formulation provided by or specifically approved by setting material manufacturer; include primers if required for concrete substrate condition.

D. Patching Compounds: Trowelable pre-mixed, latex-modified, Portland cement based formulation provided by or specifically approved by setting material manufacturer; include primers if required for concrete substrate condition.

E. Metal Trim:

1. Description: Profile and dimension suitable for thin-set application.
2. Basis of Design:

a. Flooring Transition: Schluter Systems LP; Reno-TK, stainless steel 316.
b. Carpet Transition: Schluter Systems LP; Reno-V, stainless steel 316.
c. Ramped Transition: Schluter Systems LP; Reno-U, stainless steel 316.
d. Edge: Schluter Systems LP; Schiene, stainless steel 316.

3. Available Manufacturers:

   a. Ceramic Tool Co.
   b. Schluter Systems LP.

F. Glass-Fiber Tape: Self-adhering, alkali-resistant, glass-fiber tape, 10 by 10 or 10 by 20 threads per 1 in (25 mm).; minimum 2 in (50 mm) wide.

G. Tile Cleaner: Neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, provided by or specifically approved by tile and grout manufacturers.

H. Tile and Grout Sealer: Silicone product for sealing unglazed tile and grout joints that does not change color or appearance of tile or grout, provided by or specifically approved by tile and grout manufacturers.

2.9 MIXING MORTARS AND GROUT

A. General Procedures:

1. Mix to comply with referenced quality standards and manufacturers' written instructions.
2. Add materials, water, and additives in accurate proportions.
3. Use type of mixing equipment, speeds, containers, time, and other procedures to produce uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrate surfaces to which tile will be installed for compliance with requirements, installation tolerances, and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with the Contract Documents. Starting work within a particular area will be construed as acceptance.

1. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
2. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standard: In addition to standards listed elsewhere, perform tile work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.
4. ANSI A108 installation method indicated.
5. TCNA installation method indicated.

B. General Requirements:

1. Extend tile into recesses and under or behind equipment and fixtures to form a complete covering without interruptions unless otherwise indicated.

2. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
3. Accurately form intersections and returns.
4. Perform cutting and drilling of tile without marring visible surfaces.
5. Grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints, to form smooth edges.
6. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile by not less than 1/8 in (3 mm).

C. Jointing Pattern:

1. Unless otherwise indicated, lay tile in grid pattern.
2. Align joints when adjoining tiles on floor, base, walls, and trim are same size.
3. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting.
4. Provide uniform joint widths of size recommended by tile and grout manufacturer unless otherwise indicated.
5. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.

D. Wainscots: Lay out tile to next full tile beyond dimensions indicated, and finish with bullnose shape.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Substrate Cleaning: Remove curing compounds, coatings, laitance, efflorescence, concrete dust, dirt, oil, gypsum board dust, paint, and other residue that would adversely affect or reduce bonding.

C. Concrete Floor Preparation:

1. Prepare concrete floor substrates to comply with flatness tolerance of 1/4 in in 10 ft (6 mm in 3 m) as follows:

   a. Fill cracks, holes and depressions with trowelable cementitious underlayments and patching compounds.
   b. Remove concrete protrusions, bumps, and ridges by sanding or grinding.

2. If substrate does not have fine broom finish, mechanically scarify concrete substrates to not less than ICRI CSP 4 finish.

D. Blending: Verify tile has been factory blended and packaged as specified; if not, either return to manufacturer or blend tiles at site before installing.

E. Field-Applied Temporary Protective Coating: Where needed to prevent grout from staining or adhering to exposed tile surfaces, pre-coat with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.4 CRACK ISOLATION MEMBRANE UNDERLAYMENT INSTALLATION

A. General Requirements:

1. If required by manufacturer, prime concrete substrate.

2. Install to produce a continuous crack isolation membrane of uniform thickness bonded securely to substrate, without wrinkles, bubbles, buckles, or kinks.
3. For sheets, overlap and seal seams.
4. For liquid applied products, brush or roll liquid uniformly over area in number of coats required and install reinforcing fabric.
5. Roll installed sheet if required by manufacturer.
6. After installation of tile, install floor joint sealant in tile joints recommended by manufacturer to coordinate with membrane strips.

3.5 TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Installation Quality Standard: Install tile according to following standards:

1. Medium-set Mortar: ANSI A108.5; for floor tiles 8 in by 8 in (200 mm by 200 mm) to 12 in by 12 in (300 mm by 300 mm) where subfloor is not recessed.
2. Thin-set Latex-Portland Cement Mortar: ANSI A108.5; for floor tiles less than 8 in by 8 in (200 mm by 200 mm) and smaller where subfloor is not recessed and for interior wall tiles.
3. Epoxy Mortar: ANSI A108.9.
4. Latex-Portland Grout: ANSI A108.10, typical unless indicated otherwise.
5. Epoxy Grout: ANSI A108.9, where indicated.

C. Back Buttering: For following installations, obtain minimum 95 percent mortar coverage as in referenced ANSI A108 series of installation standards:

1. Tile floors in wet and limited water exposures.
2. Tile floors installed with epoxy mortars.
3. Tile floors composed of tiles 12 in by 12 in (300 mm by 300 mm) or larger.
4. Tile floors composed of rib-backed tiles.

D. Grout Joint Widths: Install the respective types of tile with the following grout joint widths:

1. Ceramic Mosaic Tile – Less than 6 sq in (3900 mm²): 1/16 in (1.5 mm).
2. Floor Tile: 1/4 in (6 mm), maximum.
3. Wall Tile: 1/8 in (3 mm).

E. Metal Trim: Install at locations indicated and where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

F. Tile and Grout Sealer: After grout has cured, apply to unglazed tile and grout joints according to tile and sealer manufacturer's written instructions.

G. Lippage: Maximum lippage between adjacent tiles shall be 1/16 inch.

3.6 MOVEMENT JOINTS

A. Movement Joints, General: Installation Quality Standard: In accordance with TCNA Movement Joint Design Essentials EJ171 and as specified below.

B. Wall Joints: The following conditions shall not be grouted; install wall joint sealant and backer rod or backer tape:

1. Gypsum board assembly control joints.
2. Building expansion joints, unless scheduled for expansion joint cover.
3. Interior corners of tiled walls, including shower and bathtub walls.
4. Around substrates and tile at penetrations through tiled substrates.
5. At one side of changes in direction or plane of wall.
6. At joint closest and parallel to changes in substrates supporting tile between wall and floor.

C. Floor Joints:

1. General Requirements:

a. Continue construction, contraction (control), and expansion joints in building structure through tile work.
b. Isolate tile work that abuts a restraining structure or assembly.
c. When metal trim or sealant/backer is used for joint, width shall not be less than width of joint in building structure.
d. Tile shall not be placed over building expansion joints.

2. Schedule of Sealant Products and Locations:

a. Latex-Portland Cement Grouted Floors: Install floor joint sealant with backer rod at horizontal joints in mortar and grout setting conditions.
b. Epoxy Grouted Floors: Install chemical resistant floor joint sealant full depth without backer rod at horizontal joints in epoxy grout setting conditions.
c. Epoxy Mortar and Grouted Floors: Install chemical resistant floor joint sealant full depth without backer rod at horizontal joints in epoxy mortar and grout setting conditions.

3. Interior Movement Joint Spacing: As indicated on Drawings and as specified below:

a. Tile Exposed to Direct Sunlight or Moisture: 8 ft to 12 ft (2.4 m to 3.6 m) on center each way.
b. Tile Not Exposed to Sunlight: 20 ft to 25 ft (6 m to 7.5 m) on center each way.

D. Interior Floor Joint Installation Schedule: Seal interior floor movement joints, as defined by TCNA, according to following schedule:

1. Construction Joints: Floor joint sealant and backer rod.
2. Contraction (Control) Joints: Floor joint sealant and backer rod.
3. Isolation Joints: Floor joint sealant and backer rod.
4. Tile Expansion Joints: Floor joint sealant and backer rod.
5. Perimeter Joints between Wall and Floors: Floor joint sealant with backer tape.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall inspect first day's Work and periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

3.8 CLEANING

A. Cleaning:

1. Acids are not permitted, nor will they be allowed.
2. Clean tile surfaces so they are free of foreign matter.
3. Remove grout residue from tile as soon as possible.
4. No sooner than 10 days after installation, clean grout smears and haze from tile according to tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned.
5. Protect metal surfaces and plumbing fixtures from effects of cleaning.
6. Flush surfaces with clean water before and after cleaning.
7. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

3.9 DEMONSTRATION

A. Cleaning and Maintenance Training: Provide instruction to Owner's personnel for cleaning and maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use; include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

3.10 PROTECTION

A. Coverings: When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

B. Traffic Restrictions: Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

3.11 INTERIOR TILE INSTALLATION SCHEDULE

A. Floors, Concrete Substrate:

1. TCNA Installation Method F125 (Crack Isolation Membrane): Thin-set Latex-Portland cement mortar over crack isolation membrane over concrete subfloor; Latex-Portland Cement Grout.

B. Floors, Elevator Car, Cementitious Backer Unit Substrate:

1. TCNA Installation Method F144: Thin-set Epoxy mortar over cementitious backer unit; Epoxy Grout.

C. Walls, Gypsum Board Substrate:

1. TCNA Installation Method W243: Thin-set Latex-Portland cement mortar over coated-glass-mat gypsum board; Latex-Portland Cement Grout.

D. Walls, Concrete or Masonry Substrate:

1. TCNA Installation Method W202: Thin-set Latex-Portland cement mortar over concrete or masonry; Latex-Portland Cement Grout.

END OF SECTION

SECTION 09 5113

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this Section includes acoustical lay-in ceiling panels, exposed suspension systems and supplementary items necessary to complete their installation.

1.2 SUBMITTALS

A. Product Data: For each type of product specified.

B. Samples for Verification: Full-size units of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

1. 12-inch-square samples of each acoustical panel type, pattern, and color.
2. Set of 12-inch-long samples of exposed suspension system members, including moldings, for each color and system type required.

C. Product Test Reports: Indicate compliance of acoustical panel ceilings and components with requirements based on comprehensive testing of current products.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Source Limitations: Obtain each acoustical ceiling panel and each suspension system from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

1. Obtain both acoustical ceiling panels and suspension system from the same manufacturer if both are offered by the manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Fire-response tests were performed by UL.
2. Surface-burning characteristics of acoustical panels comply with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.
3. Products identified with appropriate markings of applicable testing and inspection agency.

D. Mock-ups: Before installing acoustical panel ceilings, construct mock-ups for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-ups to comply with the following requirements, using materials indicated for completed work:

1. Construct mock-ups of size indicated or, if not indicated, a minimum of 100 sq. ft.
2. Notify Architect seven days in advance of the dates and times when mock-ups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mock-ups before starting construction of acoustical panel ceilings.
5. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.
6. When directed, demolish and remove mock-ups from Project site unless approved in writing to become part of the completed Work.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 01 Section "Project Management and Coordination."

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.5 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size units equal to 2.0 percent of amount installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide specific product, material or manufacturer listed under each item below.

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classification Type III, unless otherwise indicated.

1. Colors and Patterns: Refer to Finish Legend.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106-inch-diameter wire.

D. Edge Moldings and Trim: Manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.

1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.

2.4 DIRECT-HUNG SUSPENSION SYSTEMS

A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653, G30 coating designation, with prefinished 15/16-inch-wide metal caps on flanges; other characteristics as follows:

1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flush face.
4. Cap Material: Steel sheet.
5. Cap Finish: Painted white.
6. Acceptable Manufacturer and Product:

    a. Armstrong World Industries, Inc.; Prelude.
    b. Chicago Metallic Corporation; 1200 System.
    c. USG Interiors, Inc.; Donn DX.

B. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653, G30 coating designation, with prefinished 9/16-inch-wide metal caps on flanges; other characteristics as follows:

1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flush face.
4. Cap Material: Steel sheet.

5. Cap Finish: Painted white.
6. Acceptable Manufacturer and Product:

    a. Armstrong; Suprafine.
    b. Chicago Metallic Corporation; Tempra 4000.
    c. USG Interiors, Inc.; Donn Centricitee DXT.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates surfaces to receive acoustical ceiling system and associated work and conditions under which work will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 PREPARATION

A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. Installation Quality Standard: In addition to standards listed elsewhere, perform acoustical panel ceiling work according to following, unless otherwise specified in this Section:

1. ASTM C635 and ASTM C 636 / C 636M.
2. CISCA – "Recommendations for Direct-Hung Acoustical Tile and Lay-In Ceilings – Seismic Zones 0 – 2", except as may be modified by building code.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms. Fasten hangers to cast-in-place hanger inserts, power-actuated fasteners, or drilled-in anchors that extend through forms into concrete.
6. Do not attach hangers to steel deck tabs.

7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches from ends of each member.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors. Install compression struts to meet seismic requirements.

D. Install edge moldings and trim at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
3. Provide control joints where joints occur in abutting surfaces.
4. Hold tees in place with concealed clips.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

1. Space steel main runners at 4'-0" on center.

F. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels with pattern running in one direction parallel to long axis of space.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
5. Paint cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 6115

CONCRETE FLOOR SEALER

PART 1 - GENERAL

1.1 SUMMARY

A. Work required of this Section includes sealing of exposed interior concrete floors as a finished floor material along with supplementary items necessary to complete work required for their installation.

B. Other floor sealers and curing agents not used as interior finish flooring are specified in Division 03 Section "Concrete Finishing".

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's technical literature describing specified products and instructions for evaluating, preparing, and treating the substrate.

B. Qualification Data: For Manufacturer and Installer.

1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
2. Architect may waive submittal of qualification data for available manufacturers listed in this Section.

C. Maintenance Data: Submit to include in manual specified in Division 01 Section "Closeout Procedures". Include recommendations for periodic inspections, cleaning, care, maintenance, and repair of coatings.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 2 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 2 years and with sufficient production capability, facilities, and personnel to produce required Work.

B. Installer Qualifications:

1. Experience: Installer with not less than 2 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 2 years and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project site during times specified Work is in progress that is experienced in installing systems similar to type and scope required for Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer/fabricator to install products.

C. Mock-ups: Provide a full-coat benchmark finish sample. Select one room or surface, not less than 100 square feet, to represent surfaces and conditions for application of coating and substrate. Apply sealer materials according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. After finish is accepted, the room or surface will be used to evaluate coatings of remainder of work.

1.4 PROJECT CONDITIONS

A. Environmental Conditions: Apply sealer materials within the range of ambient and substrate temperatures recommended by the manufacturer. Do not apply to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers and Products: Manufacturers offering products that may be incorporated into Work include those listed.

2.2 SEALING COMPOUND

A. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Available Manufacturers and Products:

a. Burke by Edoco; Cureseal 1315 WB.
b. ChemMasters; Polyseal WB.
c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
d. Euclid Chemical Company (The); Super Diamond Clear VOX.
e. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
f. Lambert Corporation; UV Safe Seal.
g. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
h. Meadows, W. R., Inc.; Vocomp-30.
i. Metalcrete Industries; Metcure 30.
j. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.
k. Tamms Industries, Inc.; LusterSeal WB 300.
l. Unitex; Hydro Seal 25.
m. US Mix Products Company; US Spec Radiance UV-25.
n. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive concrete floor sealer and associated work and conditions under which work will be installed. Do not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the Installer. Starting of work within a particular area will be construed as installer's acceptance of surface conditions.

1. Do not proceed with application until after the minimum concrete curing period recommended by coating manufacturer.
2. Verify substrate is visibly dry and free of moisture.

3.2 SURFACE PREPARATION

A. Clean and prepare substrate according to manufacturer's recommendations and as specified. Provide clean, dust-free, and dry substrate for application.

B. Mask off adjoining surfaces not being sealed and close off drains and other penetrations to prevent spillage and migration of liquids.

C. Remove grease, oil, paints, or other penetrating contaminants from concrete. Remove concrete fins, ridges, or other projections. Remove material to provide a sound surface free of laitance, glaze, or efflorescence. Remove remaining loose material and clean surfaces according to ASTM D 4258.

3.3 APPLICATION

A. General: Apply materials according to respective manufacturer's instructions, approved submittals and Contract Documents.

B. Sealer: Apply by spray, roller, or other applicators according to manufacturer's recommended coverage rate.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 09 6500

RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Resilient flooring products and systems and supplementary items necessary for installation.

B. Resilient wall base, reducer strips, and other accessories installed with resilient flooring are specified in Division 09 Section "Resilient Base and Accessories".

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings for Special Patterns: Show layout and details of special patterns for resilient flooring.

C. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.

D. Samples for Verification Purposes: In manufacturer's standard size, but not less than 6 in by 9 in (150 mm by 230 mm) sample of each different color and pattern of resilient flooring product specified, showing the full range of variations expected in these characteristics. Label each sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in Schedules.

1. Heat-Welded Sheet Flooring: For heat-welding bead, manufacturer's standard-size samples, but not less than 9 in (230 mm) long, of each color specified.
2. Seam Samples for Sheet Flooring: For each color and pattern of resilient sheet flooring product required; with seam running lengthwise and in center of 6 in by 9 in (150 mm by 230 mm) sample applied to a rigid backing and prepared by installer for this Project.

E. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

F. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.

G. Qualification Data: For manufacturer and installer.

1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
2. Architect may waive submittal of qualification data for available manufacturers listed in this Section.

H. Maintenance Instructions: Include in operation and maintenance manual as required by Division 01 Section "Closeout Requirements". Submit manufacturer's instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years and with sufficient production capability, facilities, and personnel to produce required Work.

B. Installer Qualifications:

1. Experience: Installer with not less than 5 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project site during times specified Work is in progress that is experienced in installing systems similar to type and scope required for Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Slip Resistance: Provide products identical to those tested for slip resistance per ASTM D 2047 with a static coefficient of friction not less than 0.6 for level surfaces and 0.8 for ramped surfaces.

D. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency.

1. Critical Radiant Flux: Class I, 0.45 W/sq. cm or greater when tested per ASTM E 648.
2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.4 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

a. Owner.
b. Architect.
c. Contractor, including superintendent.
d. Installer, including project manager and supervisor.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Work requirements (Drawings, Specifications, and other Contract Documents).

c. Review required submittals, both completed and yet to be completed.
d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
e. Review required inspection, testing, certifying, and material usage accounting procedures.
f. Review environmental conditions and procedures for coping with unfavorable conditions.
g. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store flooring products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1. Resilient Tile Flooring: Store floor tiles on flat surfaces.
2. Resilient Sheet Flooring: Store sheet flooring rolls upright.

1.6 PROJECT CONDITIONS

A. Maintain a temperature of not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C) in spaces to receive products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless otherwise recommended by manufacturer.

B. Maintain flooring products prior to installation at the same temperature as the space where they are to be installed.

C. Close spaces to traffic during flooring installation and for time period after installation recommended by manufacturer.

D. Install flooring products after other finishing operations, including painting, have been completed.

E. Do not install flooring over concrete substrates until slabs have cured and are sufficiently dry to bond with adhesive, as determined by flooring manufacturer's recommended tests. Refer to "Preparation" Article for requirements.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.8 MAINTENANCE

A. Extra Materials: Furnish the following extra materials that match and are from same production runs as products installed, packaged with protective covering for storage and identified with labels describing contents:

1. Resilient Tile Flooring: Furnish not less than 1 box for each 50 boxes or fraction thereof, of each type, color, pattern, class, wearing surface, and size of tile flooring product installed.
2. Resilient Sheet Flooring: Furnish not less than 10 linear ft (3 linear m) in roll form and full roll width, for each 500 linear ft (150 linear m) or fraction thereof, of each color, pattern, and type of sheet flooring product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality.

1. Selections: As indicated in Finish Legend.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 RESILIENT TILE FLOORING MATERIALS

A. Linoleum Floor Tile Standard: ASTM F 2195, Type I, linoleum floor tile with fibrous backing, unless otherwise indicated.

1. Size: Refer to Finish Legend.

2.4 RESILIENT SHEET FLOORING MATERIALS

A. Vinyl Sheet Floor Coverings: ASTM F 1303, Type II, Grade 1, Class A backing or ASTM F 1913 unbacked as required by product selection.

B. Heat-Welding Seam Bead: Solid-strand product of floor covering manufacturer for heat welding seams.

1. Selections: Refer to Finish Legend.

2.5 ACCESSORY MATERIALS

A. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

B. Trowelable Leveling and Patching Compounds: Latex-modified, Portland-cement-based formulation provided or approved by flooring manufacturer for products and applications indicated.

C. Adhesives: Water-resistant type recommended by flooring manufacturer suitable for products, applications, and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Typical Flooring: Not more than 50 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that concrete substrate finishes comply with requirements specified in Division 03 Section "Concrete Finishing" for concrete substrates receiving resilient flooring.
2. Verify that concrete substrates are free of cracks, ridges, depressions, scale, and foreign deposits.
3. Verify that concrete substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond.

a. Shot-blast concrete substrate with an apparatus that abrades the surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
b. Repair damaged and deteriorated concrete according to flooring manufacturer's written recommendations.

4. Determine adhesion and dryness characteristics by performing the following tests as recommended by flooring manufacturer.
5. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. A pH range of 5 to 9 is required when substrate is wetted with distilled water and pHydrion paper is applied. Proceed with installation only after concrete substrates pass testing.

6. Moisture Testing: Perform one or both of the following tests as recommended by flooring manufacturer. Perform 3 moisture tests for first 1000 sf (92.9 sm) of concrete substrate scheduled to receive flooring and 1 test for each additional 1000 sf (92.9 sm) or fraction thereof. Proceed with installation only after concrete substrates pass testing.

   a. Perform anhydrous calcium chloride test in accordance with ASTM F 1869. Proceed with installation only after concrete substrates have maximum moisture-vapor-emission rate of 3 lbs of water/1000 sf (1.36 kg of water/92.9 sm) in 24 hours.
   b. Perform relative humidity test using in situ probes in accordance with ASTM F 2170. Proceed with installation only after concrete substrates have a maximum 75 percent relative humidity level measurement.

C. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

D. Broom and vacuum clean substrates to be covered immediately before flooring product installation. After cleaning, reexamine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.4 INSTALLATION OF RESILIENT FLOORING, GENERAL

A. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings. Extend flooring to center of door openings.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on substrate. Use chalk or other nonpermanent, non-staining marking device.

E. Adhere flooring to substrates using a full spread of adhesive applied to substrate to comply with flooring manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.

   1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

F. Hand-roll flooring in both directions from center out to embed flooring in adhesive and eliminate trapped air according to manufacturer's written instructions. At walls, door casings, and other locations where access by roller is impractical, press flooring firmly in place with flat-bladed instrument.

3.5 INSTALLATION OF RESILIENT TILE FLOORING

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half of a tile at perimeter.

B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles square with room axis, unless otherwise indicated.
2. Lay tiles with grain running in one direction, unless otherwise indicated.

3.6 INSTALLATION OF RESILIENT SHEET FLOORING

A. Unroll sheet flooring and allow it to stabilize before cutting and fitting, if recommended in writing by manufacturer.

B. Lay out sheet flooring to comply with the following requirements:

1. Maintain uniformity of sheet flooring direction.
2. Arrange for a minimum number of seams and place them in inconspicuous and low-traffic areas, and not less than 6 in (150 mm) away from parallel joints in flooring substrates.
3. Match edges of sheet flooring for color shading and pattern at seams according to manufacturer's written recommendations.
4. Avoid cross seams.

C. Heat-Welded Seams: Rout joints and heat weld with welding bead, permanently fusing sections into seamless flooring. Prepare, weld, and finish seams according to manufacturer's written instructions and ASTM F 1516 to produce surfaces flush with adjoining flooring surfaces.

3.7 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing flooring products:

1. Remove adhesive and other surface blemishes from exposed surfaces using cleaner recommended by flooring manufacturer.
2. Sweep or vacuum floor thoroughly.
3. Do not wash floor until after time period recommended by flooring manufacturer.
4. Damp-mop floor to remove marks and soil.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by flooring manufacturer.

1. Cover products installed on floor surfaces with undyed, untreated building paper until just prior to Material Completion.
2. Do not move heavy and sharp objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

SECTION 09 6513

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Resilient wall base, resilient flooring accessories, and supplementary items necessary for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.

C. Samples for Verification Purposes: In manufacturer's standard size, but not less than 12 in (300 mm) sample of each different color and pattern of resilient product specified, showing the full range of variations expected in these characteristics.

D. Qualification Data: For manufacturer and installer.

1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
2. Architect may waive submittal of qualification data for available manufacturers listed in this Section.

E. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

F. Maintenance Data: To include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years and with sufficient production capability, facilities, and personnel to produce required Work.

B. Installer Qualifications:

1. Experience: Installer with not less than 5 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years and with sufficient production capability, facilities, and personnel to produce required Work.

2. Supervision: Installer shall maintain a competent supervisor who is at Project site during times specified Work is in progress that is experienced in installing systems similar to type and scope required for Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency.

1. Critical Radiant Flux: Class I, 0.45 W/sq. cm or greater when tested per ASTM E 648.
2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.4 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

a. Owner.
b. Architect.
c. Contractor, including superintendent.
d. Installer, including project manager and supervisor.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Work requirements (Drawings, Specifications, and other Contract Documents).
c. Review required submittals, both completed and yet to be completed.
d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
e. Review required inspection, testing, certifying, and material usage accounting procedures.
f. Review environmental conditions and procedures for coping with unfavorable conditions.
g. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by product manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 PROJECT CONDITIONS

A. Maintain a temperature of not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless otherwise recommended by product manufacturer.

B. Maintain resilient products prior to installation at the same temperature as the space where they are to be installed.

C. Close spaces to traffic during installation and for time period after installation recommended by manufacturer.

D. Install resilient products after other finishing operations, including painting, have been completed.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.8 MAINTENANCE

A. Extra Materials: Furnish the following extra materials that match and are from same production runs as products installed, packaged with protective covering for storage and identified with labels describing contents:

1. Furnish not less than 10 linear ft (3 linear m) for each 500 linear ft (150 linear m) or fraction thereof, of each different type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality.

1. Selections: As indicated in Finish Legend.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 RESILIENT MATERIALS

A. Rubber Wall Base:

1. Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset) or TP (rubber, thermoplastic), Group 1 and 2.
2. Thickness: Nominal 1/8 in (3 mm).
3. Outside and Inside Corners:

a. Job-formed.

B. Resilient Molding Accessories:

1. Carpeting Accessories: Carpet cove cap, carpet step-off, carpet reducer, carpet edge bar.
2. Resilient Flooring Accessories: Reducer strip and others as required.
3. Material: Rubber.
4. Color and finish as selected by Architect from manufacturer's standard colors.

2.4 ACCESSORY MATERIALS

A. Adhesives: Water-resistant type recommended by product manufacturer suitable for products, applications, and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF RESILIENT WALL BASE

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. Masonry Wall Surfaces: On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

F. Job-Formed Corners: Use straight pieces of maximum lengths possible.

1. Outside Corners: Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
2. Inside Corners: Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.5 INSTALLATION OF RESILIENT FLOORING ACCESSORIES

A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.6 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing resilient products:

1. Remove adhesive and other surface blemishes from exposed surfaces using cleaner recommended by manufacturer.
2. Sweep or vacuum horizontal surfaces thoroughly.
3. Do not wash resilient products until after time period recommended by manufacturer.
4. Damp-mop surfaces to remove marks and soil.

B. Protect resilient products against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by resilient product manufacturer.

END OF SECTION

SECTION 09 6723

RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes resinous flooring systems with epoxy body coat(s).

1. Application Method: Troweled and rolled with broadcast aggregates.

B. Sealants installed at joints in resinous flooring systems are specified in Division 07 Section "Joint Sealants."

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. Samples for Verification: For each resinous flooring system required, 6 in. (150 mm) square, applied to a rigid backing by Installer for this Project.

C. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

D. Material Test Reports: For each resinous flooring component.

E. Material Certificates: For each resinous flooring component, signed by manufacturer.

F. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.

1. Engage an installer who employs only persons trained and approved by resinous flooring manufacturer for applying resinous flooring systems indicated.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

C. Federal Agency Approvals: Where indicated, provide resinous flooring systems approved by the USDA for use indicated.

D. Mock-ups: Apply mock-ups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Apply full-thickness mock-ups on 48 in. (1200 mm) square floor area selected by Architect.

a. Include 48 in. (1200 mm) length of integral cove base.

2. Simulate finished lighting conditions for Architect's review of mock-ups.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Basis of Design: Contract Documents are based on products and assemblies (a) specified below, or, (b) indicated on Drawings by reference to an independent laboratory test number, to establish a standard of quality.

2.2 RESINOUS FLOORING

A. System Characteristics: Abrasion-, impact- and chemical-resistant, decorative-aggregate-filled, epoxy-resin-based, monolithic floor surfacing designed to produce a seamless floor.

1. Basis of Design: As scheduled Finish Legend.
2. Wearing Surface: Textured for slip resistance.
3. Overall System Thickness: 3/16 in (4.8 mm).
4. VOC Content: Not to exceed 250 g/L.

B. System Components: Manufacturer's standard components that are compatible with each other and as follows:

1. Body Coat(s):

a. Resin: Epoxy.
b. Application Method: Troweled or screeded.

1) Number of Coats: One.

c. Aggregates: Colored quartz (ceramic-coated silica).

2. Primer: Type recommended by manufacturer for substrate and body coat(s) indicated.
3. Topcoat: Chemical-resistant sealing or finish coat(s).

a. Resin: Epoxy.
b. Type: Clear.
c. Finish: Gloss.
d. Number of Coats: One.

C. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Compressive Strength: 10,000 psi per ASTM C 579.
2. Tensile Strength: 2,000 psi per ASTM C 307.
3. Flexural Strength: 4,300 psi per ASTM C 580.
4. Hardness: 85-90 per ASTM D 2240/Shore D Durometer.
5. Bond Strength: >400 psi per ASTM D 4541 (100% concrete failure).
6. Impact Resistance: >160 in. lbs. per ASTM D 4226.
7. Abrasion Resistance: 0.06 gm max. weight loss per ASTM D 4060, Taber Abrader CS-17 wheel.
8. Flexural Modulus of Elasticity: 2.0×10^6 psi per ASTM C 580.
9. Flammability: Class 1 per ASTM E 648.
10. Thermal Coefficient of Linear Expansion: 1.8×10^{-5} in/in°C per ASTM C 531.
11. Water Absorption: 0.1% per ASTM C 413.
12. Heat Resistance Limitation: 140 deg F (60 deg C) for continuous exposure; 200 deg F (93 deg C) for intermittent spills.
13. Cure Rate allow: 12 hours for foot traffic (at 77 deg F (25 deg C)) 24 hours for normal operations.

D. Acceptable Manufacturers:

1. Key Resin Company.
2. Sherwin-Williams Company; General Polymers.
3. Stonhard, Inc.

2.3 MISCELLANEOUS MATERIALS

A. Metal Edge Strips: Continuous angle or L-shape trim with integral provision for anchorage to substrate, height to match resinous flooring thickness.

1. Material: Stainless Steel.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:

a. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
3. Verify that concrete substrates are dry.

a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) of slab in 24 hours.
b. Perform plastic sheet test, ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
c. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.

4. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

3.2 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

1. Broadcast aggregates and, after resin is cured, remove excess aggregates to provide surface texture indicated.

C. Apply body coat(s) at manufacturer's recommended spreading rate.

1. Broadcast aggregates and, after resin is cured, remove excess aggregates to provide surface texture indicated.

D. Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.3 CLEANING AND PROTECTING

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION

SECTION 09 6800

CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Carpeting products and systems and supplementary items necessary for installation.

B. Resilient wall base and resilient molding accessories installed with carpeting are specified in Division 09 Section "Resilient Base and Accessories".

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Provide floor plans, including columns, doorways, enclosing walls or partitions, built-in cabinets, and locations of cutouts, to indicate the following:

1. Carpeting type and color.
2. Seam locations, types, and methods.
3. Type of installation.
4. Pattern type, location, and direction.
5. Pile direction.
6. Type, color, and location of insets and borders.
7. Type, color, and location of edge, transition, and other accessory strips.
8. Transition details to other flooring materials.

C. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.

D. Samples for Verification Purposes: In manufacturer's standard size, but not less than 6 in by 9 in (150 mm by 230 mm) sample of each different color, texture, and pattern of carpeting product specified, showing the full range of variations expected in these characteristics. Label each sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in Schedules.

E. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements. Reports shall include the following:

1. REPORT OF INVESTIGATION – FIRE PERFORMANCE CHARACTERISTICS: A report of investigation of surface burning characteristics indicating the carpet meets or exceeds the flame spread criteria and smoke density criteria as specified in the carpet specifications in the contract documents for the named Project. Such report of investigation shall be provided from the Southwest Research Institute, 6220 Culebra Road, San Antonio, Texas, 78228, Commercial Testing Company Inc., 1215 South Hamilton Street, PO Box 985, Dalton, Georgia 30720, or other approved organization.

F. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required. Certification shall include the following language:

1. SPECIMEN AFFIDAVIT OF CARPET MANUFACTURER [*to be completed and signed by an officer of the company*]

I, an officer of the carpet manufacturing company, certify the carpet delivered to [*Insert the Project Number and Name*] on or about [*date of delivery*] by the manufacturer, [*Insert manufacturer's name*], complies with the following carpet construction specification: [*Insert the complete carpet construction specifications as manufacturer*] and that such carpet construction specifications meet or exceed the carpet construction specifications in the contract documents for the name Project. I further certify the materials of the aforesaid carpet comply fully with carpet specifications in the contract documents for the named Project and are of the following description [*Insert a complete description of the materials*]

JOHN SMITH MANUFACTURING COMPANY

By: _____

Title: _____

Date: _____

G. Qualification Data: For installer.

1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.

H. Warranty: Sample of warranty.

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

I. Maintenance Instructions: Include in operation and maintenance manual as required by Division 01 Section "Closeout Requirements". Submit manufacturer's instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer with not less than 5 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project site during times specified Work is in progress that is experienced in installing systems similar to type and scope required for Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

B. Testing of Carpet: When the carpet has been suitably stored at the job site, the Construction Professional shall remove a test sample, as selected by the Design Professional, of approximately 6-1/2 x 12 feet or 7 x 7 feet. The Design Professional shall deliver the test sample to a testing laboratory selected for Carpet Testing to determine compliance with the carpet construction specifications. No carpet may be installed until the results of the testing laboratory, the Affidavit of the Carpet Manufacturers and the Reports of Investigation - Fire Performance Characteristics have been satisfactorily received and approved by the Design Professional. The Construction Professional shall allow a minimum of 45 days for the aforesaid testing and reviews by the Design Professional.

1. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below.

a. Critical Radiant Flux: Class I, 0.45 W/sq. cm or greater when tested per ASTM E 648.
b. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.4 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

a. Owner.
b. Architect.
c. Contractor, including superintendent.
d. Installer, including project manager and supervisor.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Work requirements (Drawings, Specifications, and other Contract Documents).
c. Review required submittals, both completed and yet to be completed.
d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
e. Review required inspection, testing, certifying, and material usage accounting procedures.
f. Review environmental conditions and procedures for coping with unfavorable conditions.

g. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI 104, Section 5, "Storage and Handling".

1.6 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity".

B. Environmental Limitations: Do not install carpeting until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Maintain carpeting products prior to installation at the same temperature as the space where they are to be installed.

D. Close spaces to traffic during carpeting installation and for time period after installation recommended by manufacturer.

E. Install carpeting products after other finishing operations, including painting, have been completed.

F. Do not install carpeting over concrete substrates until slabs have cured and are sufficiently dry to bond with adhesive, as determined by carpeting manufacturer's recommended tests. Refer to "Preparation" Article for requirements.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.8 WARRANTY

A. Manufacturer's Warranty for Carpeting: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Coverage of warranty includes but is not limited to more than 10 percent edge raveling, snags, runs, dimensional stability, loss of tuft bind strength, loss of face fiber, and delamination.
2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Material Completion.

B. Warranty does not include deterioration or failure of carpeting due to unusual traffic, failure of substrate, vandalism, or abuse.

1.9 MAINTENANCE

A. Extra Materials: Furnish the following extra materials that match and are from same production runs as products installed, packaged with protective covering for storage and identified with labels describing contents:

1. Tile Carpeting: Furnish full-size units of tile carpeting equal to 5 percent of amount installed for each color and type indicated, but not less than 10 sq yd (8.4 sq m).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 TILE CARPETING

A. Basis of Design (Product Standard):

1. Selections: As indicated in Finish Legend.

2.4 ACCESSORY MATERIALS

A. Concrete Slab Primer: Non-staining type as recommended by carpeting manufacturer.

B. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by carpeting manufacturer.

C. Adhesives: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and substrate conditions indicated, that complies with flammability requirements for installed carpeting and is recommended by carpeting manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.

3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation" and carpeting manufacturer's written installation instructions for preparing substrates indicated to receive carpeting installation.

C. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that concrete substrate finishes comply with requirements specified in Division 03 Section "Concrete Finishing" for concrete substrates receiving carpeting.
2. Verify that concrete substrates are free of cracks, ridges, depressions, scale, and foreign deposits.
3. Verify that concrete substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Remove substrate coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by carpeting manufacturer. Do not use solvents.
4. Determine adhesion and dryness characteristics by performing the following tests as recommended by carpeting manufacturer.
5. Alkalinity and Adhesion Testing: Perform tests recommended by carpeting manufacturer. A pH range of 5 to 9 is required when substrate is wetted with distilled water and pHydrion paper is applied. Proceed with installation only after concrete substrates pass testing.
6. Moisture Testing: Perform one or both of the following tests as recommended by carpeting manufacturer. Perform 3 moisture tests for first 1000 sf (92.9 sm) of concrete substrate scheduled to receive carpeting and 1 test for each additional 1000 sf (92.9 sm) or fraction thereof. Proceed with installation only after concrete substrates pass testing.

    a. Perform anhydrous calcium chloride test in accordance with ASTM F 1869. Proceed with installation only after concrete substrates have maximum moisture-vapor-emission rate of 3 lbs of water/1000 sf (1.36 kg of water/92.9 sm) in 24 hours.
    b. Perform relative humidity test using in situ probes in accordance with ASTM F 2170. Proceed with installation only after concrete substrates have a maximum 75 percent relative humidity level measurement.

D. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

E. Broom and vacuum clean substrates to be covered immediately before installing carpeting. After cleaning, reexamine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 INSTALLATION OF CARPETING, GENERAL

A. Scribe, cut, and fit carpeting to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

B. Extend carpeting into toe spaces, door reveals, closets, and similar openings. Extend carpeting to center of door openings.

C. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish carpeting as marked on substrate. Use chalk or other nonpermanent, non-staining marking device.

D. Do not bridge building expansion joints with carpet.

E. Bind or seal cut edges as recommended by carpeting manufacturer.

F. Install pattern parallel to walls and borders unless otherwise indicated.

G. Hand roll carpeting in both directions from center out to embed carpeting in adhesive and eliminate trapped air according to manufacturer's written instructions. At walls, door casings, and other locations where access by roller is impractical, press carpeting firmly in place with flat-bladed instrument.

3.5 INSTALLATION OF TILE CARPETING

A. Sheet Carpet at Concrete Substrates: Comply with CRI 104, Section 13, "Carpet Modules (Tiles)" and carpet manufacturer's written recommendations for full glue-down installation of every tile with releasable adhesive.

B. Install pattern parallel to walls and borders unless otherwise indicated.

3.6 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpeting:

1. Remove excess adhesive and other surface blemishes from exposed surfaces using cleaner recommended by carpeting manufacturer.
2. Remove yarns that protrude from carpeting surface.
3. Vacuum carpeting using commercial machine with face-beater element.

B. Protect installed carpeting to comply with CRI 104, Section 16, "Protecting Indoor Installations".

C. Protect carpeting against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpeting manufacturer.

END OF SECTION

SECTION 09 7200

WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Work of this section includes wall coverings and supplementary items necessary to complete the installation.

1.2 SUBMITTALS

A. Product data for each type of product specified. Include data on physical characteristics, durability, fade resistance, and flame resistance characteristics.

B. Shop drawings showing location and extent of each wall covering type. Indicate seams and termination points.

C. Samples for verification in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

1. Full-width sample, not less than 36 inches (914 mm) long, from dye lot used for the Work.
2. Submit sample with specified treatments applied for products specified.
3. Show complete pattern repeat where applicable.

D. Schedule of wall coverings using same room designations indicated on Drawings.

E. Product certificates signed by manufacturers of wall coverings certifying that their products comply with specified requirements.

F. Maintenance data for wall covering to include in the operation and maintenance manual specified in Division 01.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed 5 projects similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fire Performance Characteristics: Provide wall coverings with following surface burning characteristics as determined by testing identical products per ASTM E 84/NFPA 255/UL 723. Identify wall coverings with appropriate markings of applicable testing and inspecting organization.

1. Vinyl Wall Covering

a. Flame Spread: 25 or less.
b. Smoke Developed: 50 or less.

C. Mock-ups: Prior to installing wall covering, construct mock-ups for each wall covering and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-ups to comply with the following requirements, using materials indicated for final unit of Work.

1. Locate mock-ups on-site in the location and of the size indicated or, if not indicated 100 sq. ft. in a typical room.
2. Notify Architect 7 days in advance of the dates and times when mock-ups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain approval of mock-ups before start of final unit of Work.
5. Retain and maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Approved mock-ups in an undisturbed condition at the time of Material Completion may become part of the completed Work.

1.4 PROJECT CONDITIONS

A. Do not install wall covering until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

B. Lighting: Do not install wall covering until a lighting level of not less than 15 foot-candles (160 lux) is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by the wall covering manufacturer for full drying or curing.

1.5 EXTRA MATERIALS

A. Furnish extra materials from same production runs as each type and color of wall covering installed. Package materials with protective covering and identify with labels describing contents. Deliver extra materials to Owner. Furnish quantity of full-size units equal to 5 percent of amount installed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide specific product, material or manufacturer listed under each item below.

2.2 WALL COVERING MATERIALS

A. Vinyl Wall Covering: Provide integrally pigmented, opaque virgin vinyl calendared film vinyl wall covering material treated with mildew and antimicrobial additives and laminated to suitable backing. Comply with FS CCC-W-408A, Type II (except where Type I is specifically scheduled), Class 1, and CFFA W-101A.

1. Stain-Resistant: Provide material for toilet rooms wet walls with delustered clear polyvinyl fluoride film not less than 0.0005 inch (1/2 mil) thick as top coating complying with FS L-P-1040, Type I, Grade B, Class 2 (DuPont "Tedlar"). Do not include weight of stain-resistant coating as part of required vinyl coating weight or total fabric weight.

B. Tackable Wall Covering: Provide uni-color resilient homogeneous tackable linoleum surface consisting of linseed oil, granulated cork, rosin binders, and dry pigments calendared onto natural burlap backing. Color shall extend through thickness of material.

1. Gauge: 1/4 inch (6 mm).

C. Selections (Color, Pattern and Texture):

1. Refer to Finish Legend for selection of manufacturer, style and colors.

2.3 ADHESIVES

A. General: Manufacturer's standard for use with specific wall covering and substrate application.

B. Characteristics: Mildew-resistant, nonstaining, and strippable. In compliance with local applicable VOC regulations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive wall coverings and associated work and conditions under which work will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to Installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 PREPARATION

A. Acclimatize wall covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

B. Comply with manufacturer's written instructions for surface preparation.

C. Clean substrates of substances that could impair wall covering's bond, including mold, mildew, oil, grease, incompatible primers, and dirt.

D. Prepare substrates to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, and defects.

1. Painted Surfaces: Treat areas susceptible to pigment bleeding with products recommended by wall covering manufacturer.
2. Metals: If not factory primed, clean and apply rust-inhibitive zinc primer.
3. Prime new gypsum board with primer recommended by wall covering manufacturer.
4. Allow new plaster to cure. Moisture content of 5 percent maximum. Treat areas of high alkalinity.

E. Check painted surfaces for pigment bleeding and treat susceptible areas. Sand gloss, semi-gloss, and eggshell finishes with fine sandpaper.

F. Where recommended by wall covering manufacturer install wall liner to form smooth wrinkle-free surface for finished installation. Do not begin wall covering installation until wall liner has dried.

3.3 INSTALLATION

A. Comply with wall coverings manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Cut wall covering panels in roll number sequence. Change run numbers at partition breaks and corners only.

C. Install wall covering with no gaps or overlaps.

D. Match patterns and shading variations.

E. Install seams vertical and plumb at least 6 inches from outside corners and 3 inches from inside corners. No horizontal seams.

F. Remove air bubbles, wrinkles, blisters, and other defects.

G. Trim edges for color uniformity, pattern match, and tight closure at seams and edges. Butt seams.

3.4 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended by the wall covering manufacturer.

C. Replace strips that cannot be cleaned.

END OF SECTION

SECTION 09 9100

PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Surface preparation and field painting of exposed exterior and interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where indicated that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts, hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels, unless indicated otherwise.

1. Prefinished items include the following factory-finished components:

a. Prefinished wood doors.
b. Acoustical materials.
c. Prefinished Architectural woodwork and cabinets.
d. Elevator equipment.
e. Finished mechanical and electrical equipment.
f. Light fixtures.
g. Distribution cabinets.
h. Baked enamel coated items.
i. Fluorocarbon coated items.
j. Integral colored PVC.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Foundation spaces.
b. Furred areas.
c. Ceiling plenums.
d. Utility tunnels.
e. Pipe spaces.
f. Duct shafts.
g. Elevator shafts.

3. Finished metal surfaces include the following:

   a. Anodized aluminum.
   b. Stainless steel.
   c. Chromium plate.
   d. Copper and copper alloys.
   e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:

   a. Valve and damper operators.
   b. Linkages.
   c. Sensing devices.
   d. Motor and fan shafts.

5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

   a. Embossed UL labels may be used and painted where acceptable to authority having jurisdiction.

D. Refer to Division 09 Section "Gypsum Board Assemblies" for surface preparation of gypsum board assemblies.

1.2 DEFINITIONS

A. MPI Gloss Levels: MPI Gloss and Sheen Standard values are measured per ASTM D 523, Method D and are as follows:

1. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees.
2. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees.
3. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
4. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees.
5. Gloss Level 5: 35 to 70 units at 60 degrees.
6. Gloss Level 6: 70 to 85 units at 60 degrees.
7. Gloss Level 7: More than 85 units at 60 degrees.

B. Exterior Painting: Generally includes surfaces located in unconditioned spaces.

C. Interior Painting: Generally includes surfaces located in conditioned spaces.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, installation instructions, and recommendations for maintenance.

B. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 in (200 mm) square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Field Quality Control Test Reports: Written report of testing and inspection required by "Field Quality Control" Article below.

E. Manufacturers Project Acceptance Document: Certification that products are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that warranty will be issued.

1. Certifications by manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

F. Qualification Data: For manufacturer and installer.

1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
2. Architect may waive Submittal of Qualification Data for Available Manufacturers listed in this Section.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 10 years, and with sufficient production capability, facilities and personnel, to produce required Work.

B. Installer Qualifications:

1. Experience: Installer with not less than 5 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years, and with sufficient production capability, facilities and personnel, to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project during times specified Work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed or acceptable to manufacturer to install products.

C. Manufacturers Technical Representative Qualifications: Direct employee of technical services department of manufacturer with minimum of 5 years experience in providing recommendations, observations, evaluations, and problem diagnostics.

D. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."

2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" and "MPI Maintenance Repainting Manual" for products and paint systems indicated.

E. Mock-ups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mock-up in the location and of the size indicated or, if not indicated, as directed by Architect.

a. Architect will select one surface to represent surfaces and conditions for application of each paint system.

1) Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
2) Other Items: Architect will designate items or areas required.
3) Demonstrate repair procedures for damaged surfaces.

b. Apply samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.

c. Final approval of color selections will be based on benchmark samples.

1) If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

2. Clean exposed faces of mock-up.
3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Protect approved mock-up from the elements with weather-resistant membrane.
6. Obtain Architect's approval of mock-ups before starting fabrication.
7. Maintain mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.
8. Approval of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and approved by Architect in writing.
9. Demolish and remove mock-ups when directed by Architect unless approved to become part of the completed Work.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

a. Owner.
b. Architect.
c. Contractor, including superintendent.
d. Installer, including project manager and superintendent.
e. Manufacturer/fabricator's qualified technical representative.
f. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

   a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
   b. Review Work requirements (drawings, specifications, and other Contract Documents).
   c. Review required submittals, both completed and yet to be completed.
   d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   e. Review required inspection, testing, certifying, and material usage accounting procedures.
   f. Review environmental conditions and procedures for coping with unfavorable conditions.
   g. Resolve deviations or differences between Contract Documents and the manufacturer/fabricator's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 PROJECT CONDITIONS

A. Apply paints only when temperatures of surfaces to be painted and surrounding air are between minimum and maximum range recommended by manufacturer.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers/Fabricators and Products: Manufacturers/fabricators offering products that may be incorporated into the Work include those listed.

1. Benjamin Moore & Co.
2. Dunn-Edwards Corporation.
3. Frazee Paint.
4. ICI Paints.
5. Pratt & Lambert Paints
6. PPG Architectural Finishes, Inc.
7. Sherwin-Williams Company (The).

B. Product Standards (Basis of Design): Contract Documents are based on products specified to establish a standard of quality.

C. Color and Gloss: As indicated in Finish Legend.

2.2 PAINT, GENERAL

A. Source Limitations: Obtain block fillers and field applied primers for each coating system from the same manufacturer as the finish coats.

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

2.3 BLOCK FILLERS

A. Interior/Exterior Latex Block Filler: MPI #4; for exterior and interior concrete masonry units.

1. VOC Content: E Range of E2, 51 - 100 g/l, or E3, less than 51 g/l.
2. Manufacturers and Products:

a. Benjamin Moore Moorcraft Super Craft Latex Block Filler 285-01 E3
b. Dunn-Edwards Concrete Block Concrete Block Filler Smooth W315 E2
c. Frazee Paint Frazee Paint Int/Ext Block Filler 262 E3
d. ICI Paints Devoe Coatings Bloxfil Acrylic Block Filler 4000-1000 E2
e. PPG Pittsburgh Paints Speedhide Int/Ext Acrylic Masonry Block Filler 6-15 E3
f. Sherwin-Williams PrepRite Int/Ext Block Filler B25W25 E3

2.4 EXTERIOR PRIMERS/SEALERS

A. Rust-Inhibitive Primer (Water Based): MPI #107; for exterior ferrous metal.

1. VOC Content: E Range of E2, 101 - 150 g/l, or E3 less than 101 g/l.
2. Environmental Performance Rating: EPR2 or EPR3.

3. Manufacturers and Products:

    a. Benjamin Moore Super Spec High Performance Acrylic Metal Primer P04/KP04 E3 EPR3
    b. ICI Paints Devoe Coatings Devflex DTM Flat Int/Ext W.B. Primer 4020 E3 EPR3
    c. PPG Pitt-Tech® Plus Int/Ext DTM Industrial Primer White 90-912 E3 EPR3
    d. Sherwin-Williams Industrial & Marine DTM Acrylic Primer/Finish B66W1 E2 EPR2

B. Waterborne Galvanized-Metal Primer: MPI #134; for exterior and interior galvanized metal.

1. VOC Content: E Range of E2, 101 - 150 g/l, or E3 less than 101 g/l.
2. Environmental Performance Rating: EPR2 or EPR3.
3. Manufacturers and Products:

    a. Dunn-Edwards Ultra-Grip Acrylic Multi-Purpose Primer W 715 E3 EPR3
    b. Frazee Paint Frazee Paint Acrylic Metal Primer 561 E3 EPR3
    c. ICI Paints Devoe Coatings Devflex WB DTM Primer Finish 4020 E3 EPR3
    d. PPG PPG Int/Ext WB Industrial Primer 90-912 E3 EPR3
    e. Pratt & Lambert Steeltech High HP Acrylic Primer Z6631 E3 EPR3
    f. Sherwin-Williams Industrial & Marine DTM Acrylic Primer/Finish B66W1 E2 EPR2

2.5 INTERIOR PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50; for interior concrete, plaster and gypsum board.

1. VOC Content: E Range of E1, 101 - 150 g/l, or E2, 51 - 100 g/l, or E3 less than 51 g/l.
2. Environmental Performance Rating: EPR1 or EPR2 or EPR3.
3. Manufacturers and Products:

    a. Benjamin Moore Regal Primer & Underbody N216-00/F216-00 E 2 EPR2
    b. Dunn-Edwards Acri-Loc Acrylic Masonry Primer/Sealer W6232 E 1 EPR1
    c. Frazee Paint Aqua Seal II Interior Vinyl Acrylic Wall Sealer 061 E 3 EPR3
    d. ICI Paints Prep & Prime Hi-Hide Wall Interior Water-Based Primer Sealer 1000-1200 E 2 EPR2
    e. PPG Speedhide Int. Latex Primer Sealer 6-2 E 2 EPR2
    f. Pratt & Lambert Pro-Hide Gold Interior Latex Wall Primer Z8160 E 2 EPR2
    g. Sherwin-Williams ProMar 200 Inteiror Latex Primer B28W8200 E 2 EPR2

B. Rust-Inhibitive Primer (Water Based): MPI #107; for interior ferrous metal.

1. VOC Content: E Range of E2, 101 - 150 g/l, or E3 less than 101 g/l.
2. Environmental Performance Rating: EPR2 or EPR3.
3. Manufacturers and Products:

    a. Benjamin Moore Super Spec High Performance Acrylic Metal Primer P04/KP04 E3 EPR3
    b. ICI Paints Devoe Coatings Devflex DTM Flat Int/Ext W.B. Primer 4020 E3 EPR3
    c. PPG Pitt-Tech® Plus Int/Ext DTM Industrial Primer White 90-912 E3 EPR3
    d. Sherwin-Williams Industrial & Marine DTM Acrylic Primer/Finish B66W1 E2 EPR2

C. Waterborne Galvanized-Metal Primer: MPI #134; for exterior and interior galvanized metal.

1. VOC Content: E Range of E2, 101 - 150 g/l, or E3 less than 101 g/l.
2. Environmental Performance Rating: EPR2 or EPR3.

3. Manufacturers and Products:

   a. Dunn-Edwards Ultra-Grip Acrylic Multi-Purpose Primer W 715 E3 EPR3
   b. Frazee Paint Frazee Paint Acrylic Metal Primer 561 E3 EPR3
   c. ICI Paints Devoe Coatings Devflex WB DTM Primer Finish 4020 E3 EPR3
   d. PPG PPG Int/Ext WB Industrial Primer 90-912 E3 EPR3
   e. Pratt & Lambert Steeltech High HP Acrylic Primer Z6631 E3 EPR3
   f. Sherwin-Williams Industrial & Marine DTM Acrylic Primer/Finish B66W1 E2 EPR2

2.6 WATER-BASED, LIGHT-INDUSTRIAL COATINGS, EXTERIOR

A. Semigloss, Water-Based, Light-Industrial Coating, Exterior: MPI #163 (MPI Gloss Level 5); for exterior metal surfaces unless otherwise indicated.

1. VOC Content: Minimum E Range of E2, 151 - 250 g/l, or E3 less than 151 g/l.
2. Manufacturers and Products:

   a. Dunn-Edwards Permasheen Int/Ext 100% Acrylic Semi-Gloss W 901 E2
   b. ICI Paints (Canada) Dulux Diamond Semi-Gloss Acrylic 13210 E3
   c. PPG Pitt-Tech Plus 100% Acrylic Semi-Gloss Low VOC 90-1210 E3
   d. Sherwin-Williams Industrial & Marine Sher-Cryl HPA Semi-Gloss B66W351 E2

2.7 LATEX PAINTS, INTERIOR

A. Institutional Low-Odor/VOC Latex (Flat): MPI #143 (Gloss Level 1); for interior surfaces unless otherwise indicated.

1. VOC Content: E Range of E3 less than 11 g/l.
2. Environmental Performance Rating: EPR4.
3. Manufacturers and Products:

   a. Benjamin Moore Eco Spec Int. Latex Flat W219 E3 EPR4
   b. Dunn-Edwards Ecoshield Low-Odor/Zero-VOC Interior Latex Flat W 601 E3 EPR4
   c. Frazee Paint Frazee Paint Envirokote Flat 018 E3 EPR4
   d. ICI Paints Dulux Lifemaster Flat Interior Latex Enamel 9100-0100 E3 EPR4
   e. PPG Pure Performance Interior Latex Flat 9-100 E3 EPR4
   f. Sherwin-Williams Harmony Interior Latex Flat B5W951 E3 EPR4

B. Institutional Low-Odor/VOC Latex (Low Sheen): MPI #144 (Gloss Level 2); for interior surfaces unless otherwise indicated.

1. VOC Content: E Range of E3 less than 11 g/l.
2. Environmental Performance Rating: EPR4.5.
3. Manufacturers and Products:

   a. Benjamin Moore Eco Spec Int. Latex Eggshell Enamel W223 E3 EPR4.5
   b. ICI Paints Devoe Paint Wonder Pure Eggshell Interior Latex Enamel DRN32XX E3 EPR4.5
   c. PPG Interior Eggshell White Pastel Base CP-5184 E3 EPR4.5
   d. Sherwin-Williams Harmony Interior Latex Eg-Shel B09W00951 E3 EPR4.5

C. Institutional Low-Odor/VOC Latex (Eggshell): MPI #145 (Gloss Level 3); for interior surfaces unless otherwise indicated.

1. VOC Content: E Range of E3 less than 11 g/l.
2. Environmental Performance Rating: EPR4.5.
3. Manufacturers and Products:

a. Frazee Paint Frazee Envirokote Eggshell 0290001 E3 EPR4.5

D. Institutional Low-Odor/VOC Latex (Semigloss): MPI #147 (Gloss Level 5); for interior surfaces unless otherwise indicated.

1. VOC Content: E Range of E3 less than 11 g/l.
2. Environmental Performance Rating: EPR5.5.
3. Manufacturers and Products:

a. Benjamin Moore Eco Spec Int. Latex Semi-Gloss Enamel W224 E3 EPR5.5
b. Dunn-Edwards Ecoshield Low-Odor/Zero-VOC Interior Acrylic S-G W 603 E3 EPR5.5
c. Frazee Paint Frazee Paint EnviroKote Semi Gloss 032 E3 EPR5.5
d. ICI Paints Dulux Lifemaster Semi-Gloss Interior Latex Enamel 9200-0100 E3 EPR5.5
e. PPG Pure Performance Interior Semi-Gloss Latex 9-500 E3 EPR5.5
f. Sherwin-Williams Harmony Interior Latex Semi-Gloss B10W00951 E3 EPR5.5

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to shop applicators to ensure use of compatible primers.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform gypsum fabrications work according to the following, unless otherwise specified in this Section:

1. Respective manufacturer/fabricator's written installation instructions.
2. Approved submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" and "MPI Maintenance Repainting Manual" applicable to substrates and paint systems indicated.

C. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates, unless expressly permitted by authorities having jurisdiction for labels intended to be painted.

D. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

E. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

1. Use mechanical methods of surface preparation recommended by paint manufacturer.
2. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

F. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

G. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

1. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

1. Galvanized metal substrates shall not be chromate passivated. If galvanized metal is chromate passivated, provide surface preparation and primers recommended by manufacturer.

I. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

J. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.4 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items, equipment, and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items, equipment, or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Paint interior surfaces of non-ducted return air penums with a flat, nonspecular black paint where visible through registers or grilles.
5. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
6. The number of coats and film thickness required are the same regardless of application method.
7. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
8. Omit primer over metal surfaces that have been shop primed and touchup painted.
9. Allow sufficient time between successive coats to permit proper drying.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve total dry film thickness of the entire system as recommended by manufacturer.

F. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces, exterior walls and on roofs including, but not limited to, the following:

1. Mechanical Work:

a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe hangers and supports.
d. Tanks that do not have factory-applied final finishes.
e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets with a flat, nonspecular black paint.
f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

2. Electrical Work:

a. Switchgear.
b. Panelboards.

c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.5 FIELD QUALITY CONTROL

A. Manufacturer/Fabricator's Field Service: Manufacturer/fabricator's qualified technical representative, not a sales representative, shall inspect first days work and periodically inspect work of this Section to insure installation is proceeding in accordance with manufacturer/fabricator's recommendations and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings and conclusions of inspection.

3.6 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces to match approved samples.

3.7 PIPE IDENTIFICATION

A. Mechanical Rooms: Provide complete painting of piping in mechanical rooms only.

B. Conform to requirements of OSHA and ASA A13, "Scheme for Identification of Pipe Systems," as published by American Society of Mechanical Engineers.

3.8 FIRE AND SMOKE BARRIER IDENTIFICATION

A. Corridor partitions, smokestop partitions, horizontal exit partitions, exit enclosures and fire walls shall be effectively and permanently identified with signs, labels or stencils in a manner acceptable to authority having jurisdiction.

1. Identification shall be above decorative ceiling and in concealed spaces.

3.9 EXTERIOR PAINTING SCHEDULE

A. Steel Substrates (Ferrous Metal):

1. Water-Based, Light-Industrial Coating System: MPI EXT 5.1M

a. Prime Coat: Rust-inhibitive primer, (water based), primer.
b. Intermediate Coat: Water-based, light-industrial coating, matching topcoat.
c. Topcoat: Water-based, light-industrial coating.
d. Gloss and Sheen: Refer to Painting Finish Schedule.

B. Galvanized-Metal Substrates:

1. Water-Based, Light-Industrial Coating System: MPI EXT 5.3J.

a. Prime Coat: Waterborne galvanized-metal primer.
b. Intermediate Coat: Water-based, light-industrial coating, matching topcoat.
c. Topcoat: Water-based, light-industrial coating.
d. Gloss and Sheen: Refer to Painting Finish Schedule.

3.10 INTERIOR PAINTING SCHEDULE

A. CMU Substrates:

1. Institutional Low-Odor/VOC Latex System: MPI INT 4.2E.

a. Prime Coat: Interior/exterior latex block filler.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex.
d. Gloss and Sheen: Refer to Painting Finish Schedule.

B. Steel Substrates:

1. Institutional Low-Odor/VOC Latex System: MPI INT 5.1S.

a. Prime Coat: Rust-inhibitive primer (water based).
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex.
d. Gloss and Sheen: Refer to Painting Finish Schedule.

C. Galvanized-Metal Substrates:

1. Institutional Low-Odor/VOC Latex System: MPI INT 5.3N.

a. Prime Coat: Waterborne galvanized-metal primer.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex.
d. Gloss and Sheen: Refer to Painting Finish Schedule.

D. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.

a. Prime Coat: Interior latex primer/sealer.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex.
d. Gloss and Sheen: Refer to Painting Finish Schedule.

E. Acoustical Plaster Substrates:

1. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.

a. Topcoat: Institutional low-odor/VOC interior latex.
b. Gloss and Sheen: Refer to Painting Finish Schedule.

F. Cotton or Canvas Insulation-Covering Substrates: Including pipe and duct coverings.

1. Institutional Low-Odor/VOC Latex System: MPI INT 10.1D.

a. Prime Coat: Interior latex primer/sealer.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex.
d. Gloss and Sheen: Refer to Painting Finish Schedule.

END OF SECTION

SECTION 09 9713

COATINGS FOR STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes application of special coating systems to items and surfaces scheduled, including surface preparation, prime coat, intermediate coat and topcoat and supplementary items necessary to complete work required for their installation.

1.2 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product Data: Submit manufacturer's specifications to evidence compliance with these specifications. Include label analysis of finish coating.

C. Samples: Prior to beginning work, the Architect will furnish color chips for surfaces to be coated. Use exact colors when preparing samples for review. Submit samples for review of color and texture only. Provide a list of material and application procedures for each coat of each finish sample. Resubmit samples as requested until the required sheen, color and texture is achieved.

1. Ferrous Metal: Provide two 8-inch-square samples of solid metal for each color selected. Define prime and finish coats.

D. Certifications: Submit certification from Supplier that Applicator is licensed to install coating system.

E. Submit manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

A. Single Source Responsibility: Provide primer material produced by the same manufacturer as the finish coats. Use only thinners recommended by the manufacturer, and only within recommended limits.

B. Material Quality: Provide the best quality grade of the various coatings as regularly manufactured by acceptable coating manufacturers. Materials not displaying manufacturer's identification as a best-grade product will not be acceptable.

C. Regulatory Requirements: Coating products shall meet Federal, State and Local EPA requirements for maximum VOC.

D. Applicator: Applicator shall be licensed by Supplier.

1.4 JOB CONDITIONS

A. Apply coatings only when the temperature of surfaces to be coated and surrounding air temperatures are above 45 deg F (7 deg C), unless otherwise permitted by manufacturer's printed instructions.

B. Do not apply coatings in snow, rain, fog or mist, or when the relative humidity exceeds 85 percent, or at temperatures less than 5 deg F (3 deg C) above the dew point, or to damp or wet surfaces unless otherwise permitted by manufacturer's printed instructions. Allow wet surfaces to dry thoroughly and attain the temperature and conditions specified before proceeding with or continuing the coating operation.

1.5 EXTRA STOCK

A. Leave on premises, where directed by Architect, not less than five (5) gallons, in one gallon cans, of finish coating for each color used.

B. Containers shall be tightly sealed.

C. Label each container with color, color number, texture and locations, in addition to manufacturer's label.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Carboline.
2. Coronado Paint Company "Coronado".
3. Glidden Company "Glidden".
4. Porter International.
5. Sherwin-Williams Company "Sherwin-Williams".
6. Tnemec.

2.2 MATERIALS

A. Primer: Organic Zinc Rich Primer. Provide factory formulated prime coat material compatible with the substrate and finish coats indicated. Primer shall be a two or three component polyamide epoxy zinc-rich coating. Primers shall contain no lead.

1. Carboline: No. 858.
2. Coronado: Polyamide Epoxy Zinc Rich Primer, 101-152.
3. Porter: Zinc-Lock No. 308.
4. Sherwin-Williams: Zinc Clad IV.
5. Tnemec: 90-94.

B. Intermediate Coat: High Build Epoxy. Provide factory formulated polyamide epoxy intermediate coat compatible with prime coat and topcoat indicated.

1. Carboline: No. 893.
2. Coronado: Polyamide Epoxy, 111-111.
3. Porter: "M.C.R. High Build Epoxy" No. 4500.
4. Sherwin-Williams: "Recoatable Epoxy Primer", B67 Series.
5. Tnemec: Series 66 "Hi-Build Epoxoline".

C. Topcoat: Acrylic. Provide factory formulated single component, water-based 100 percent acrylic. Material shall be compatible with intermediate coat indicated. Acrylic used in coating shall be equal to Rohm & Haas HG-54 industrial acrylic resin. Sheen shall be semi-gloss.

1. Carboline: No. 3359.
2. Coronado: DTM Semi-Gloss, 182-1.
3. Porter: Acri-Shield No. 3440.
4. Sherwin-Williams: DTM Acrylic Coating, B66 Series.
5. Tnemec: Series 29, TUF-CRYL.

D. Color of Topcoat: To match AF-1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive special coatings system and associated work and conditions under which work will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 PREPARATION

A. Prepare substrate surfaces to insure proper and adequate installation, in accordance with the Contract Documents and approved Shop Drawings, or manufacturer's requirements.

B. Clean surfaces before applying coatings or surface treatments. Schedule cleaning and coating application so dust and other contaminates will not fall on wet, newly coated surfaces.

C. Ferrous Metal Surfaces: Clean non-galvanized, ferrous metal surfaces, that have not been shop-coated; remove oil, grease, dirt, loose mill scale and other foreign substances. Use solvent or mechanical cleaning methods that comply with the recommendations of the Steel Structures Painting Council.

1. Remove grease and oil by solvent cleaning as recommended by the coating manufacturer and in accordance with SSPC SP1.
2. Surfaces shall receive a commercial blast cleaning as recommended by the coating system manufacturer and in accordance with the requirements of SSPC specification SSPC SP6 and SSPC-SP-COM.

D. Steel Deck Units: Remove grease and oils and provide "wash coat" of a primer recommended by the paint manufacturer to prepare deck units to receive intermediate and topcoats as indicated.

3.3 MATERIAL PREPARATION

A. Material Preparation: Carefully mix and prepare materials in compliance with the coating manufacturer's directions.

1. Stir materials before application to produce a mixture of uniform density, and as required during application. Do not stir film, which may form on surfaces, into the material. Remove film and, if necessary, strain the coating material before using.

B. Tinting: Tint intermediate coat a lighter shade to facilitate identification of each coat where multiple coats of the same material are to be applied.

3.4 APPLICATION

A. Apply special coatings by brush, roller, spray, or other applicators in accordance with manufacturer's directions. Use brushes best suited for the material being applied.

1. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
2. Minimum Coating Thickness: Apply each material at not thinner than the manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by the manufacturer.
3. Mechanical Application: Use mechanical methods for coating application when permitted by the manufacturer's recommendations. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double-back with spray equipment building-up film thickness of 2 coats in one pass, unless recommended by the manufacturer.

B. Primer: Shop apply prime coat as recommended by the manufacturer, to material required to be coated or finished, and which has not been prime coated by others.

C. Intermediate Coat: Shop applied or field applied at contractor's option and as recommended by the manufacturer. Apply intermediate coat within 30 days.

1. Prior to application of field applied intermediate coat, primer shall be power-washed or light brush-off blasted to remove all loose dirt and foreign contaminants as recommended by the manufacturer.
2. If 30 day re-coat window of primer is exceeded, perform surface preparation as recommended by the manufacturer in addition to or in conjunction with power-wash cleaning.
3. If intermediate coat is shop applied, power-wash intermediate coat to remove all loose dirt and foreign contaminants prior to field application of topcoat.
4. Galvanized steel decking units shall be cleaned, as recommended by manufacturer prior to application of acrylic top coats. Damaged areas shall be spot primed.
5. Touch-up shop applied prime coats which have been damaged, and bare areas. Wire-brush, solvent clean, and touch-up with the same primer as the shop coat.

D. Topcoat: Shall be field applied and as recommended by the manufacturer. Match approved samples for color, texture and coverage. Remove, refinish or re-coat work not in compliance with specified requirements.

3.5 FIELD QUALITY CONTROL

A. The Design Professional reserves the right to invoke the following test procedure at any time, and as often as the Owner deems necessary, during the period when coating operations are being conducted.

1. The Design Professional will engage the services of an independent testing laboratory to sample the coating being used. Samples of material delivered to project site will be taken, identified and sealed, and certified in the presence of the Contractor.
2. The testing laboratory will perform appropriate tests for the following characteristics as required by the Owner:

a. Quantitative materials analysis.
b. Absorption.
c. Color retention.
d. Abrasion resistance.

e. Apparent reflectivity.
f. Washability.
g. Dry Film Thickness.
h. Recoating.
i. Skinning.

3. If results show materials being used do not comply with requirements, the Contractor may be directed to stop work, and remove non-complying materials, pay for testing, re-coat surfaces coated with rejected materials, or remove rejected materials from previously coated surfaces if, upon recoating with specified materials, the two coatings are not compatible.

3.6 CLEANING

A. At the end of each work day, remove rubbish, empty cans, rags and other discarded materials from the site.

3.7 PROTECTION

A. Protect work of other trades, whether to be coated or not, against damage from coating. Correct damage by cleaning, repairing, replacing, and re-coating as acceptable to the Architect. Leave in an undamaged condition.

B. At completion of construction activities of other trades, touch-up and restore damaged or defaced coated surfaces.

3.8 SCHEDULE OF COATING SYSTEM

A. Provide the following coating systems for substrates indicated. Apply additional coats when undercoats or other conditions show through the final coat, until the cured film is of uniform coating finish, color and appearance.

B. Exposed Interior Structural Steel:

1. Acrylic Topcoat: Provide intermediate coat of epoxy and finish coat of acrylic over organic zinc-rich metal primer with a total dry film thickness of between nine (9) mils and twelve (12) mils with nine (9) mils being a minimum.

a. Spaces: Public Circulation 1.011, Public Circulation 1.012, North Commons 1.015, Future Connector N.I.C.

END OF SECTION

SECTION 10 1100

VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 SUMMARY

A. Work for this section includes visual display surfaces and supplementary items necessary to complete their installation.

1.2 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product Data: For each type of visual display board indicated.

C. Shop Drawings: For each type of visual display board required.

1. Include dimensioned elevations. Show location of joints between individual panels where unit dimensions exceed maximum panel length.
2. Include sections of typical trim members.
3. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and textures available.

E. Samples for Verification: Of specified products, showing color and texture or finish selected. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected. Prepare Samples from the same material to be used for the Work.

1. Visual Display Surfaces: Sample panels not less than 8-1/2 by 11 inches (215 by 280 mm), mounted on the substrate indicated for the final Work. Include a panel for each type, color, and texture required.
2. Aluminum Trim and Accessories: Samples of each finish type and color, on 6-inch- (150-mm-) long sections of extrusions and not less than 4-inch (100-mm) squares of sheet or plate. Include Sample sets showing the full range of color variations expected.
3. Tackboards: Sample panel not less than 8-1/2 by 11 inches (215 by 280mm) for each type, color and texture required.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain visual display surfaces through one source from a single manufacturer.

1.4 WARRANTY

A. Porcelain Enamel Warranty: Submit a written warranty executed by manufacturer agreeing to replace porcelain enamel boards that do not retain their original writing and erasing qualities, exhibit excessive fading of color, or exhibit crazing, cracking, or flaking for the lifetime of the original installation, provided the manufacturer's written instructions for handling, installation, protection, and maintenance have been followed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Best-Rite Chalkboard Co.
2. Carolina Chalkboard Co.
3. Claridge Products and Equipment, Inc.
4. Ghent Manufacturing Inc.
5. Greensteel, Inc.
6. Lemco, Inc.
7. Marsh Chalkboard Co.
8. Nelson Adams.

2.2 MATERIALS

A. Porcelain Enamel Panels: Balanced, high-pressure-laminated, porcelain enamel panels of 3-ply construction consisting of face sheet, core material, and backing.

1. Face Sheet: 0.024-inch (0.61-mm) enameling grade steel especially processed for temperatures used in coating porcelain on steel. Coat exposed face and edges with a 3-coat process consisting of primer, ground coat, and color cover coat. Coat concealed face with a 2-coat process consisting of primer and ground coat. Fuse cover and ground coats to steel at manufacturer's standard firing temperatures, but not less than 1200 deg F (649 deg C).

   a. Markerboard/Whiteboard Cover Coat: Provide manufacturer's standard, light-colored, special writing surface with gloss finish intended for use with erasable dry markers.

2. Core: 3/8-inch- (9.5-mm-) thick, particleboard core material complying with requirements of ANSI A208.1, Grade 1-M-1.
3. Backing Sheet: 0.015-inch- (0.38-mm-) thick, aluminum-sheet backing.
4. Laminating Adhesive: Manufacturer's standard, moisture-resistant, thermoplastic-type adhesive.

2.3 ACCESSORIES

A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062-inch- (1.57-mm-) thick, extruded-aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units. Keep joints to a minimum. Miter corners to a neat, hairline closure.

1. Where size of visual display surfaces or other conditions require support in addition to normal trim, provide structural supports or modify trim as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.
2. Factory-Applied Trim: Manufacturer's standard narrow trim with no visible screws or exposed joints.

3. Chalktray: Manufacturer's standard, continuous, solid, extrusion-type, aluminum chalktray with ribbed section and smoothly curved exposed ends for each chalkboard.

2.4 FABRICATION

A. Porcelain Enamel Boards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive.

B. Assembly: Provide factory-assembled units, unless field-assembled units are required.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
2. Provide manufacturer's standard vertical joint system between abutting sections of chalkboards.
3. Provide manufacturer's standard mullion trim at joints between chalkboards and tackboards.

2.5 FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine wall surfaces, with Installer present, for compliance with requirements and other conditions affecting installation of visual display surfaces.

1. Surfaces to receive visual display surfaces shall be free of dirt, scaling paint, and projections or depressions that would affect installation.
2. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Deliver factory-built visual display surfaces completely assembled in one piece without joints, where possible. If dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain

B. Install units in locations and at mounting heights indicated and according to manufacturer's written instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.3 ADJUSTING AND CLEANING

A. Verify that accessories required for each unit have been properly installed.

B. Clean units according to manufacturer's written instructions.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 101423

PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes code required signs, including ADA, and supplementary items necessary to complete their installation.

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, mounting heights, layout, spacing, reinforcement, accessories, and installation details.

1. Provide message list for each sign, including large-scale details of wording, lettering, and Braille layout.

C. Samples for Initial Selection: For each type of sign material indicated that involves color selection.

D. Samples for Verification: For each type of sign, include the following Samples to verify color selected:

1. Panel Signs: Full-size Samples of each type of sign required.
2. Dimensional Characters: Full-size Samples of each type of dimensional character (letter and number) required. Show character style, material, finish, and method of attachment.
3. Approved samples will not be returned for installation into Project.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

B. Regulatory Requirements: Comply with code provisions and with Americans with Disabilities Act (ADA) for the following:

1. Tactile and Braille Characters.
2. Typestyles.
3. Character Height.
4. Pictograms (Symbols).
5. Finish and Contrast.
6. Mounting Location and Height.

C. Single-Source Responsibility: Obtain each sign type through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. ASI Sign Systems, Inc.
2. Best Manufacturing Company.
3. Mohawk Sign Systems.
4. Seton Identification Products.
5. The Supersine Company.

2.2 MATERIALS

A. Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 deg F.

1. Colored Coatings: Use colored coatings, including inks and paints for copy and background colors, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.
2. Mounting Fasteners: Use concealed fasteners fabricated from materials that are not corrosive to the sign material and mounting surface.

2.3 FABRICATION

A. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished with square coat edge condition and square corner condition.

B. Graphic Content and Style: Provide sign copy that complies with requirements indicated and ADA for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.

C. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.

D. Typical Sign Design:

1. Material: Cast-acrylic sheet.
2. Perimeter: Unframed.
3. Copy: Tactile and Braille.
4. Character Style: Helvetica.
5. Text: As indicated in the Sign Schedule to identify location.
6. Message: Fixed.
7. Sizes: Minimum required to meet code and ADA requirements.
8. Colors: As selected from manufacturer's standard colors.

2.4 FINISHES

A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive panel signage and associated work and conditions under which work will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.

1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
2. Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using one method indicated below:

1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
2. Silicone-Adhesive Mounting: Use liquid-silicone adhesive recommended in writing by sign manufacturer to attach signs to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended in writing by sign manufacturer to hold sign in place until adhesive has fully cured.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

3.4 SCHEDULE OF SIGNS

A. Stairs:

1. Provide a sign at each door to each stairway on each floor.
2. Message:

a. Required wording for exiting. "**STAIR WAY**".
b. Braille message as required by ADA.

B. Elevator Lobbies:

1. Provide a sign at each elevator group on other than Level One.

2. Provide a sign at each elevator group on all levels.

   a. Message:

      1) Required wording and diagram for exiting.

         "IN CASE OF FIRE
         DO NOT USE ELEVATORS
         USE STAIRS"

      2) Graphic symbols that are appropriate, including Fire Evacuation Map.
      3) Braille message as required by ADA.

   b. Mount above elevator call button.

C. Toilet Rooms:

1. Provide a sign at the door to each public toilet room.
2. Message:

   a. "**MEN**" or "**WOMEN**" as appropriate for the room.
   b. Graphic symbol that is appropriate for the room.
   c. Symbol of accessibity.
   d. Braille message as required by ADA.
   e. Room number.

D. Maintenance Rooms:

1. Provide a sign at each door that leads into the following rooms:

   a. **ELECTRICAL ROOM**
   b. **JANITOR CLOSET**
   c. **MECHANICAL ROOM**
   d. **ELEVATOR MACHINE ROOM**

2. Braille message as required by ADA.
3. Room number.

E. Typical Rooms:

1. Provide a sign at each door not categorized above.
2. Braille message as required by ADA.
3. Room number.

END OF SECTION

SECTION 10 2113

TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Work for this section includes standard, manufactured toilet compartments and supplementary items necessary to complete work required for their installation.

B. Supports for attaching compartments to overhead structural system are specified in Division 05 Section "Metal Fabrications".

C. Toilet accessories, attached to or recessed through partitions are specified in Division 10 Section "Toilet Accessories".

1.2 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product Data: For each type and style of toilet compartment and screen specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.

C. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of reinforcement and cutouts for compartment-mounted toilet accessories.

D. Samples for Initial Selection: Manufacturer's color charts consisting of sections of actual units showing the full range of colors, textures, and patterns available for each type of compartment or screen indicated.

E. Samples for Verification: Of each compartment or screen color and finish required, prepared on 6-inch- (150-mm-) square Samples of same thickness and material indicated for Work.

1.3 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Solid Plastic - Phenolic with Melamine Facing:

a. Accurate Partitions Corp.
b. American Sanitary Partition Corp.
c. Ampco Products, Inc.
d. Bobrick Washroom Equipment, Inc.
e. Capitol Partitions, Inc.
f. Columbia Partitions - Partition Systems Inc.
g. Flush-Metal Partition Corp.
h. General Partitions Manufacturing Corp.
i. Global Steel Products Corp.
j. Knickerbocker Partition Corp.
k. Metpar Steel Products Corp.
l. The Mills Company.
m. Monarch Toilet Partitions, Inc.
n. Sanymetal Products - Crane Plumbing Co.

2.2 MATERIALS

A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.

B. Solid-Plastic, Phenolic Core: Solid phenolic core with melamine facing on both sides, fused to substrate without visible glue line or seam. Provide units with eased edges and with minimum 3/4-inch- (19-mm-) thick doors and pilasters and minimum 1/2-inch- (13-mm-) thick panels and screens.

C. Pilaster Shoes and Sleeves (Caps): ASTM A 666, Type 302 or 304 stainless steel, not less than 0.0312 inch (0.8 mm) thick and 3 inches (75 mm) high, finished to match hardware.

D. Full-Height (Continuous) Brackets: Manufacturer's standard design, Type 302 or 304 stainless steel brackets for attaching screens to walls.

E. Hardware and Accessories: Manufacturer's standard design, Type 302 or 304 stainless steel operating hardware and accessories.

F. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.3 FABRICATION

A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars.

B. Ceiling-Hung Compartments: Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.

C. Wall-Hung Screens: Provide units in sizes indicated of same construction and finish as compartment panels, unless otherwise indicated.

D. Doors: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide in-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments indicated to be handicapped accessible.

1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
4. Door Pull: Manufacturer's standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.

2.4 COLOR SELECTION

A. Color: One of manufacturer's standard colors in each room, as indicated or, if not indicated, as selected by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than 1/2 inch (13 mm) between pilasters and panels and not more than 1 inch (25 mm) between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.

1. Secure panels to walls and panels with not less than 2 stirrup brackets attached near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

B. Ceiling-Hung Compartments: Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust so bottoms of doors are level with bottoms of pilasters when doors are in closed position.

C. Screens: Attach with anchoring devices according to manufacturer's written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.2 ADJUSTING AND CLEANING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and swing doors in entrance screens to return to fully closed position.

B. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration at the time of Material Completion.

END OF SECTION

SECTION 10 2115

CUBICLE SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes cubicle specialties and supplementary items necessary to complete their installation.

1.2 PERFORMANCE REQUIREMENTS

A. Curtains: Provide curtain fabrics with the following characteristics:

1. Fabrics are launderable to a temperature of not less than 160 deg F.
2. Fabrics are flame resistant and are identical to those that have passed NFPA 701 when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.

    a. Identify fabrics with appropriate markings of applicable testing and inspecting agency.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications to evidence compliance with these specifications.

B. Shop Drawings:

1. Show details of the system, related construction and reflected layout of ceiling areas showing location of tracks in relation to other ceiling mounted items.
2. Indicate materials, finishes, dimensions, thicknesses and/or gages of parts, reinforcement, where applicable, and anchorage including items of hardware and accessories necessary for complete installation.

C. Samples for Verification: Full-size units of each type of the following products:

1. Curtain Fabric: 12-inch-square swatch or larger Sample as required to show complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.
2. Curtain Track: Not less than 4 inches long.
3. Curtain Carrier: Full-size unit.
4. IV Track: Not less than 4 inches long.
5. IV Hanger: Full-size unit.

D. Cubicle Schedule: Use same room designations as indicated on Drawings.

E. Maintenance Data: For each product if specified to include in maintenance manuals specified in Division 01.

1.4 QUALITY ASSURANCE

A. Mock-up: Build mock-up to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Build mock-up of typical cubicle, complete with tracks, IV hanger, and curtain if specified.
2. Approved mock-up may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install cubicle specialties until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where cubicle specialties are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Curtain Carriers and Track End Caps: Full-size units equal to 3 percent of quantity installed for each size indicated, but not less than 10 units.
2. Curtains: Full-size units equal to 10 percent of quantity installed, but not less than 2 units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers/Fabricators and Products: Provide product by one of manufacturers/fabricators listed.

2.2 CURTAIN TRACKS

A. Extruded-Aluminum Track: Not less than 1-1/4 inches wide by 3/4-inch-high, with minimum wall thickness of 0.058 inch.

1. Curved Track: Factory fabricated 12-inch-radius bends.
2. Finish: Baked enamel, acrylic, or epoxy, white color.

B. Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.

C. Curtain Carriers: Two nylon rollers and nylon axle with chrome-plated steel, stainless steel, or aluminum hook with nickel plated steel beaded chain curtain drop.

D. Exposed Fasteners: Stainless steel.

E. Concealed Fasteners: Hot-dip galvanized.

F. Acceptable Manufacturers:

1. General Cubicle Company, Inc.
2. Imperial Fastener Company, Inc.
3. InPro Corporation.
4. Nelson, A. R. Co.
5. Salsbury Industries.

2.3 IV SUPPORT SYSTEMS

A. Extruded-Aluminum IV Track: Not less than 1-1/4 inches wide by 3/4-inch-high; with minimum wall thickness of 0.058 inch.

1. Curved Track: Factory fabricated 12-inch-radius bends.
2. Finish: Baked enamel, acrylic, or epoxy, white color.

B. IV Carriers: Four nylon rollers and steel or stainless-steel axles, with hanger loop fabricated from 1/4-inch-diameter stainless steel.

C. Telescoping IV Hangers: 3/4-inch stainless-steel main shaft and a 3/8-inch stainless-steel inner shaft, vertically adjustable 16 inches; with 4 non folding 1/4-inch stainless-steel arms with loops and a stainless-steel top loop to attach to carrier.

D. Acceptable Manufacturers:

1. General Cubicle Company, Inc.
2. Imperial Fastener Company, Inc.
3. InPro Corporation.
4. Nelson, A. R. Co.
5. Salsbury Industries.

2.4 CURTAINS

A. Cubicle Curtain Fabric: Subject to compliance with requirements, provide the following:

1. Refer to Finish Legend.

B. Mesh Top: No. 50 (1/2 inch) nylon mesh. Top 20 inches of curtain.

1. Color: As selected by Architect from manufacturer's full range.

C. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches o.c.; machined into top hem.

D. Curtain Tieback: Nickel-plated brass chain; one at each curtain termination.

E. Fabrication: Fabricate curtains to comply with the following requirements:

1. Width: Finished width of panel to be 3-inches less than specified fabric width.
2. Length: Equal to floor-to-ceiling height minus depth of track and carrier at top, and minus 15 inch distance above finished floor at bottom.

3. Mesh Top: Top hem not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched. Double lock stitch bottom of mesh directly to 1/2-inch triple thickness, top hem of curtain fabric.
4. Bottom Hem: Not less than 1 inch and not more than 1-1/2 inches wide, double thickness and double lock stitched.
5. Side Hems: Not less than 1-inch and not more than 1-1/2 inches wide, with double thickness and double lock stitch.
6. Vertical Seams: Not less than 1/2 inch wide, double turned and double stitched.
7. Top Hem: Triple thickness with edges turned and stitched top and bottom.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install tracks level and plumb, according to manufacturer's written instructions. Provide track fabricated from one continuous length up to 16 feet.

1. Curtain Track Mounting: Surface.
2. IV Track Mounting: Surface.

B. Surface Track Mounting: Fasten surface-mounted tracks at intervals of not less than 24 inches. Fasten support at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation. Mechanically fasten to suspended ceiling grid with screws.

C. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.

D. IV Hangers: Unless otherwise indicated, install one IV hook on each IV track and hang one IV hanger.

E. Curtain Carriers: Provide curtain carriers adequate for 6-inch spacing along the full length of the curtain plus an additional carrier.

F. Curtains: Hang curtains on each curtain track. Secure with curtain tieback.

1. Install number of curtain panel units necessary for length of track to ensure that the total length is not less than 10 percent longer than length of track.
2. Top corners of each curtain panel is to share one curtain carrier so that when leading curtain panel is pulled, then all panels are interlocked and move as one continuous curtain.

END OF SECTION

SECTION 10 2226

OPERABLE PANEL PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes operable panel partitions and supplementary items necessary to complete their installation.

1.2 ACOUSTICAL PERFORMANCE REQUIREMENTS

A. Sound Transmission Requirements: Provide operable panel partition assembly tested by a qualified testing agency in a full-scale opening, 14 by 9 feet, for laboratory sound transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.

1. Sound Transmission Class (STC): 52.

1.3 SUBMITTALS

A. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable panel partition, component, and accessory specified. Include data on acoustical performance, surface-burning characteristics, and durability.

B. Shop Drawings: Show location and extent of operable panel partitions. Include plans, elevations, sections, details, numbered panel installation sequence, attachments to other construction, and accessories. Indicate dimensions; weights; conditions at openings and for storage; and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, and direction of travel. Show blocking to be provided by others. Include the following:

1. Calculations: Calculate requirements for supporting operable panel partitions and verify capacity of carriers and track components to support loads; indicate deflection limits for partition and adjacent construction.

C. Setting Drawings: For embedded items and cutouts required in other work, including support beam punching template.

D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for facings and factory-applied color finishes of accessories.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for the Work. If finishes involve normal color, pattern or texture variations, include sample sets showing the full range of variations expected.

1. Panel Face Material: Manufacturer's standard-size unit, not less than 12 inches square.
2. Panel Edge Material: Not less than full width by 6 inches long.

F. Product Certificates: Signed by manufacturers of operable panel partitions certifying that products furnished comply with requirements.

G. Product Test Reports: From a qualified testing agency indicating that each operable panel partition complies with requirements, based on comprehensive testing of current products.

H. Maintenance Data: For the following to include in maintenance manuals specified in Division 01:

1. Panel face finishes and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
2. Seals, hardware, track, carriers, and other operating components.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified in writing by the operable panel partition manufacturer as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.

B. Fire-Test-Response Characteristics: Provide operable panel partitions with the following fire-test-response characteristics, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: As follows, per ASTM E 84:

a. Flame Spread: 25 or less.
b. Smoke Developed: 450 or less.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify operable panel partition openings and storage arrangements by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening and storage dimensions and proceed with fabricating operable panel partitions without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Advanced Equipment Corp.; Alpha series.
2. Hufcor Inc.; Spectrum 6000 series.
3. Kwik-Wall Co.; 3000 series.
4. Moderco Partitions.
5. Modernfold, Inc.; Acousti-Seal 940 series.
6. Panelfold, Inc.; Moduflex 800 series.

2.2 MATERIALS

A. Steel Frame: Steel sheet, not less than 0.0598-inch (16 gage) nominal specified thickness for uncoated steel.

B. Aluminum Trim: Alloy and temper recommended by aluminum producer and finisher for type of use, corrosion resistance, and finish indicated; ASTM B 221 for extrusions; manufacturer's standard strengths and thicknesses for type of use.

C. Steel Face/Liner Sheets: Tension-leveled steel sheet, not less than 0.299-inch (22 gage) nominal specified thickness for uncoated steel.

2.3 OPERABLE PANEL PARTITIONS

A. Panel Construction: Provide top reinforcement as required to support panel from suspension components and provide reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

B. Dimensions: Fabricate operable panel partitions, from manufacturer's standard sizes, to form an assembled system of dimensions indicated on Drawings and verified by field measurements.

C. Cap-Trimmed Edges: Protective aluminum top and bottom edge trim with tight hairline joints concealing edges of panel and finish facing. Manufacturer's standard clear anodized.

D. Vertical Trimless Edges: Fabricate vertical exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

E. Operable Panel Partition Characteristics:

1. Manually operated, paired panels.

F. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.

G. Panel Thickness: Manufacturer's standard, nominal 4 inches.

2.4 SEALS

A. General: Provide types of acoustical seals that produce operable panel partitions complying with acoustical performance requirements and the following:

1. Seals made from materials and profiles that minimize sound leakage.
2. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended, closed, and in place.

B. Vertical Seals: Deep-nesting, interlocking astragals mounted on each edge of panel, with continuous PVC acoustical seal.

C. Horizontal Top Seals: Continuous-contact, extruded-PVC or PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on track when extended.

D. Horizontal Bottom Seals: PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.

1. Mechanically Operated: Extension and retraction of bottom seal by operating handle or built-in operating mechanism, with operating range not less than the 2-inch operating clearance between retracted seal and floor finish.

2.5 FINISH FACING

A. General: Provide finish facings that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.

1. Apply one-piece, seamless facings free from air bubbles, wrinkles, blisters, and other defects, with invisible seams complying with Shop Drawings for location, and with no gaps or overlaps. Horizontal seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.
2. Match facing pattern 72 inches above finished floor.

B. High-Pressure Decorative Laminate: NEMA LD 3, HGS laminated to fire-retardant wood core with moisture-resistant adhesive.

1. Color and Pattern: As selected by Architect from manufacturer's standard colors.

2.6 SUSPENSION SYSTEMS

A. Suspension Tracks: Steel or aluminum with adjustable steel hanger rods for overhead support, designed for type of operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

1. Panel Guide: Aluminum; finished with factory-applied, decorative, protective finish.

a. Color: White.

2. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.

a. Color: White.

B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.

C. Track Intersections, Switches, and Accessories: As required for type of operation, storage, track configuration, and layout indicated for operable panel partition, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.

D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish, unless otherwise indicated.

E. Steel Finish: Factory-applied, corrosion-resistant, protective coating, unless otherwise indicated.

2.7 ACCESSORIES

A. Storage Pocket Door: Full height at end of partition runs to conceal stacked partition; of same materials, finish, construction, thickness, and acoustical qualities as panels; complete with operating hardware. Hinges in finish to match other exposed hardware.

1. Rim Lock: Deadlock to receive cylinder, to secure pocket door in closed position. Refer to Division 08 Section "Door Hardware" for lock cylinder and keying requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.

B. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as applicator's acceptance of installation conditions.

3.2 INSTALLATION

A. General: Comply with ASTM E 557, operable panel partition manufacturer's written installation instructions, Drawings, and approved Shop Drawings.

B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

3.3 ADJUSTING

A. Adjust operable panel partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

3.4 CLEANING AND PROTECTION

A. Clean soiled surfaces on completing installation of operable panel partitions, to remove dust, adhesives, and other foreign materials according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure operable panel partitions are without damage or deterioration at time of Material Completion.

C. Replace panels that cannot be cleaned and repaired, in a manner approved by Architect, before time of Material Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

1. Test and adjust seals, hardware, carriers, tracks, and other operable components. Replace damaged or malfunctioning operable components.
2. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
3. Review data in maintenance manuals. Refer to Division 01 Section "Closeout Procedures."

END OF SECTION

SECTION 10 2613

WALL AND CORNER GUARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Impact-resistant wall protection systems, wall and corner guards, and supplementary items necessary for installation.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's technical literature for each wall protection system component indicated; include physical characteristics, such as durability, resistance to fading, and flame resistance.

B. Shop Drawings: Submit showing locations, extent, and installation details of each wall protection system component; indicate methods of attachment to adjoining construction.

C. Plastic Samples for Initial Selection: Submit manufacturer's color charts consisting of sections of plastic material showing full range of colors and textures available for each wall protection system component indicated.

D. Plastic Samples for Verification Purposes: Submit for following products showing full range of color and texture variations expected in each wall protection system component:

1. Wall Protection: 12-inch-square samples of each wall protection system component required with 6 inch long samples of moldings and trims.

E. Maintenance Data: Include for each wall protection system component to include in maintenance manuals specified in Division 01. Include recommended methods and frequency for maintaining optimum condition of plastic covers under anticipated traffic and use conditions, and precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each color, grade, finish, and type of wall protection system component from a single source with resources to provide components of consistent quality in appearance and physical properties.

B. Fire-Test-Response Characteristics: Provide wall protection system components with surface-burning characteristics indicated, as determined by testing identical materials according to ASTM E 84 by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify wall protection system components with appropriate markings of applicable testing and inspecting agency.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver, store or install wall protection system components until space is enclosed and weatherproof, and ambient temperature within building is maintained at not less than 70 deg F for not less than 72 hours before beginning installation.

1.5 MAINTENANCE

A. Extra Materials: Furnish as described below packaged with protective covering and identified with labels describing contents.

1. Full-size units of maximum length, including plastic cover and aluminum retainer, equal to 2 percent of each type, color, and texture of each type of unit installed, but not less than 2 units.
2. Accessory components from same production run as materials installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Provide product by one of manufacturers listed.

1. American Floor Products Co., Inc.
2. Arden Architectural Specialties, Inc.
3. Balco, Inc.
4. C/S Group – Construction Specialties, Inc.
5. IPC Door and Wall Protection Systems; Division of InPro Corp.
6. Koroseal Wall Protection Systems; Division of RJF International Corp.
7. Pawling Corp.
8. Tepromark International, Inc.

B. Product Standards (Basis of Design): Contract Documents are based on C/S Group products listed to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and do not change intended aesthetic, functional and performance requirements as judged by Architect.

2.2 MATERIALS

A. Plastic Material:

1. Description: Textured, chemical- and stain-resistant, high-impact-resistant, PVC or acrylic-modified vinyl plastic with integral color throughout; extruded for wall and corner guard profiles and sheets for wall protection; with following minimum physical properties:

a. Impact Resistance: Minimum 25.4 foot-pounds per inch of notch when tested according to ASTM D 256, Test Method A.
b. Chemical and Stain Resistance: Pass when tested according to ASTM D 543.
c. Self-Extinguishing: Pass when tested according to ASTM D 635.
d. Flame-Spread Index: 25 or less.
e. Smoke-Developed Index: 450 or less.

2. Color and Texture: As scheduled in Finish Legend.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified for alloy 6063-T5; thickness as indicated.

C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other non-corrosive metal screws, bolts, and other fasteners compatible with aluminum components, hardware, anchors, and other items being fastened. Use theft-proof fasteners where exposed to view.

D. Stainless Steel Plate: ASTM A 240, Type 304.

E. Adhesive for Wall Protection: Manufacturer's product for use with wall protection material on substrate indicated.

2.3 STAINLESS STEEL TYPE CORNER GUARDS

A. Drawing Designation CG-13 and CG-14 – Surface-Mounted Stainless Steel Corner Guards:

1. Description: Fabricated from 0.0625 inch (16 gage) thick stainless steel; 3-1/2 by 3-1/2 inch wings; with formed edges and 90 degree corner; with No. 4 directional, satin finish, with strippable plastic temporary protection.
2. Mounting Method: Stainless steel flat-head screws.
3. Product Standard – Drawing Designation CG-13 and CG-14: C/S Group – "CO-8".

2.4 PLASTIC WALL PROTECTION

A. Drawing Designation WP – Surface-Mounted Plastic Wall Protection:

1. Description: Fabricated from 0.060 inch thick extruded plastic sheets; with match wainscot and joint moldings and outside and inside corner trims as required.
2. Mounting Method: Adhesive.
3. Product Standard: C/S Group – "Acrovyn".

2.5 FABRICATION

A. General Requirements: Fabricate wall protection system components to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including thicknesses of components.

1. Preassemble components in shop to greatest extent possible to minimize field assembly.
2. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Conditions: Examine substrate surfaces to which wall protection system components will be installed for compliance with requirements, installation tolerances and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance.

3.2 INSTALLATION

A. Installation Quality Standard: In addition to standards listed elsewhere, perform wall protection work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Approved submittals.
3. Contract Documents.

B. General Requirements:

1. Install components level, plumb, and true to line without distortions.
2. Materials with chips, cracks, voids, stains, or other defects that might be visible in finished Work shall not be installed.

3.3 CLEANING

A. General Requirements: Clean plastic covers and accessories according to manufacturer's written instructions.

END OF SECTION

SECTION 10 2813

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Toilet accessories and supplementary items necessary for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, dimensions, and profiles of individual components.
2. Include details for cutouts required in other Work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

B. Accessory Schedule: Organized by rooms, indicating types, quantities, sizes, and installation locations of each accessory, using drawing designations and room names and numbers as indicated on Drawings.

C. Qualification Data: For manufacturer and installer.

1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
2. Architect may waive submittal of qualification data for available manufacturers listed in this Section.

D. Warranty: Sample of special warranty.

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

E. Maintenance Data: For inclusion in operation and maintenance manual as required by Division 01 Section "Closeout Procedures". Include manufacturer's instructions for maintenance of installed Work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years and with sufficient production capability, facilities, and personnel to produce required Work.

B. Installer Qualifications:

1. Experience: Installer with not less than 5 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project site during times specified Work is in progress that is experienced in installing systems similar to type and scope required for Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Mock-Ups: Prior to beginning Work of this Section, install mock-ups of toilet accessories, incorporating backup wall construction, to demonstrate surface preparation. Build mock-up using materials indicated for the completed Work.

1. If Architect determines mock-up does not comply with requirements, reconstruct mock-ups until accepted.
2. Accepted mock-ups may become part of completed Work if undisturbed at time of Material Completion.

1.4 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

a. Owner.
b. Architect.
c. Contractor, including superintendent.
d. Installer, including project manager and supervisor.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate and other preparatory work performed by other trades.
b. Review Work requirements (Drawings, Specifications, and other Contract Documents).
c. Review required submittals, both completed and yet to be completed.
d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
e. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.5 COORDINATION

A. Coordinate installation of products with interfacing and adjoining construction to provide a successful installation without failure.

1.6 WARRANTY

A. Mirror Manufacturer's Warranty: Furnish warranty for a period of 15 years from date of Material Completion agreeing to replace mirrors that develop visible silver spoilage defects, signed by an authorized representative using manufacturer's standard form.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Available Manufacturers and Products: Manufacturers offering products that may be incorporated into Work include those listed.

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corp.
5. Brey Krause Manufacturing.
6. GAMCO - General Accessory Manufacturing Co.

B. Basis of Design: Contract Documents are based on products specified to establish a standard of quality.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

B. General Requirements:

1. Unless otherwise indicated, fabricate units of all-welded construction, with corners and returns as indicated, tight seams and joints, and exposed edges rolled.
2. Fabricate frames drawn and leveled, one-piece seamless construction.
3. Hang doors and access panels with full-length, stainless-steel hinges.
4. Equip units for concealed anchorage and with corrosion-resistant backing plates.

C. Manufacturer Names or Labels: Not permitted on exposed faces of accessories. Provide printed label or stamped metal nameplate indicating manufacturer's name and product model number on an easily noticeable interior surface or on back surface of each accessory.

D. Keys: Provide minimum of 6 universal keys for internal access to accessories for servicing and resupplying.

E. Accessibility Requirements: Products and installation shall comply with Americans with Disabilities Act (ADA), ANSI A 117.1, and state and local accessibility standards.

2.3 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 satin finish; minimum 0.0312 in (0.8 mm) (22 gage) nominal thickness unless otherwise indicated.

B. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 1/4 in (6 mm) thick, with silvering, electroplated copper coating, and protective organic coating.

C. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

D. ABS Plastic: Moldable acrylonitrile-butadiene-styrene resin formulation.

E. HDPE Plastic: Moldable high-density polyethylene resin formulation.

F. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

G. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of non-corrosive metal when concealed.

H. Sealant: Silicone mildew resistant sealant specified in Division 07 Section "Joint Sealants".

2.4 PAPER TOWEL DISPENSERS

A. Drawing Designation A1 - Surface-Mounted Paper Towel Dispenser:

1. Description: Fabricated of stainless steel; with hinged front equipped with full length stainless steel piano hinge and tumbler lock; pierced slots at sides as refill indicators; and sized to dispense 800-ft pull rolls.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-2860.

2.5 TOILET TISSUE DISPENSERS

A. Drawing Designation B9 - Surface-Mounted Twin Jumbo Roll Toilet Tissue Dispenser:

1. Description: Fabricated of stainless steel, cabinet of 0.040 in (1.0 mm) (20 gage) thick, door of 0.050 in (1.25 mm) (18 gage) thick; door with viewing slot, continuous piano hinge and tumbler lock; sized to store two 10 in (250 mm) diameter, 3 in (75 mm) diameter core type, tissue roll; spindles convertible to standard size toilet tissue rolls.
2. Basis of Design: Bobrick Washroom Equipment, Inc.; Model B-2892.

2.6 WASTE RECEPTACLES

A. Drawing Designation C1 - Surface-Mounted Waste Receptacle:

1. Description: Fabricated of stainless steel; with seamless exposed walls and continuously welded bottom pan; with removable 20 gal (75.7 L) capacity heavy-gauge vinyl liner secured to receptacle with interior stainless steel hooks.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-279.

2.7 COMBINATION TOWEL DISPENSER / WASTE RECEPTACLES

A. Drawing Designation D1 - Semi-Recessed-Mounted Combination Towel Dispenser / Projecting Waste Receptacle:

1. Description: Fabricated of stainless steel; with seamless exposed flange; towel dispenser in upper portion of unit with hinged front, equipped with full length stainless steel piano hinge, designed to dispense not less than 800 foot pull roll paper towels; projecting waste receptacle in lower portion of unit secured in place by tumbler lock, provided with removable 12 gal (45.5 L) capacity heavy-gauge vinyl liner secured to receptacle with interior stainless steel hooks; for nominal 4 in (100 mm) wall depth.
2. Basis of Design: Bobrick Washroom Equipment, Inc.; Model B-3961.

2.8 GRAB BARS

A. Drawing Designation E1, E2, E3, E4, E5, and E16 - Configured Surface-Mounted Satin Finish Grab Bar with Slip-Resistant Gripping Surface:

1. Description: Fabricated of stainless steel tube; with minimum 0.050 in (1.25 mm) (18 gage) wall thickness and 1-1/2 in (38 mm) outside diameter, with 1-1/2 in (38 mm) clearance between wall surface and inside face of bar.

    a. Gripping Surfaces: Satin texture with peened gripping surfaces.
    b. Shapes: Either as indicated, or as required by condition requiring the grab bar.
    c. Mounting: Concealed flanged steel plate welded to end of bar, as required by mounting condition, with snap-on cover; engineered to support minimum 300 lbs (136 kg).

2. Basis of Design:

    a. E16: Bobrick Washroom Equipment, Inc.; Model B-6897.99, 42 in x 54 in (1050 mm x 1350 mm) unit.

2.9 SANITARY NAPKIN VENDORS

A. Drawing Designation F2 - Recessed-Mounted Sanitary Napkin Vendor:

1. Description: Fabricated of stainless steel; with seamless door with returned edges, minimum 0.050 in (1.25 mm) (18 gage) thick, equipped with full length stainless steel piano hinge, door-swing cable limiter, and two tumbler locks; identification reading "Napkins" and "Tampons" at coin slots; brand name advertising not allowed; for nominal 4 in (100 mm) wall depth.

    a. Capacity: Not less than 31 napkins and 22 tampons.
    b. Coin Mechanism: Field convertible, impact-resistant mechanism with pull-knob, with locked coin box keyed separately from door and other toilet accessory units; factory set at fifty-cent coin operation.

2. Basis of Design: Bobrick Washroom Equipment, Inc.; Model B-3500 X 2 50.

2.10 SANITARY NAPKIN DISPOSAL UNITS

A. Drawing Designation G1 - Surface-Mounted Sanitary Napkin Disposal Unit:

1. Description: Fabricated of stainless steel; with flush door equipped with continuous piano hinge and tumbler lock; self-closing disposal panel with spring-loaded full length stainless steel piano hinge and international symbol for sanitary napkin disposal; with removable 1.2 gal (4.6 L) capacity molded polyethylene receptacle.
2. Basis of Design: Bobrick Washroom Equipment, Inc.; Model B-254.

B. Drawing Designation G3 - Partition-Mounted Dual-Access Sanitary Napkin Disposal Unit:

1. Description: Fabricated of stainless steel; with seamless adjustable exposed flange at both partition faces; self-closing disposal panel at both partition faces with spring-loaded full length stainless steel piano hinge and international symbol for sanitary napkin disposal; with removable 1.2 gal (4.6 L) capacity molded polyethylene receptacle.
2. Basis of Design: Bobrick Washroom Equipment, Inc.; Model B-354.

2.11 SOAP DISPENSERS

A. Drawing Designation J1 - Surface-Mounted Soap Dispenser:

1. Description: Fabricated of stainless steel; with stainless steel cover with unbreakable clear acrylic refill indicator window; minimum 40 fl oz (1.2 L) capacity liquid soap dispenser, with stainless steel piston, springs, and internal parts designed to dispense in measured quantity by pump action.
2. Basis of Design: Bobrick Washroom Equipment, Inc.; Model B-2112.

B. Drawing Designation J3 - Counter-Mounted Soap Dispenser:

1. Description: Designed for mounting through lavatory counter; polished stainless steel piston and spout-type unit with 6 in (150 mm) long duckbill-style spout, chrome-plated high-impact resistant ABS deck escutcheon, and polyethylene reservoir concealed below deck; minimum 34 fl oz (1.0 L) capacity liquid soap dispenser.
2. Basis of Design: Bobrick Washroom Equipment, Inc.; Model B-8226.

2.12 TOILET SEAT COVER DISPENSERS

A. Drawing Designation K2 - Recessed-Mounted Toilet Seat Cover Dispenser:

1. Description: Fabricated of stainless steel; with seamless exposed flange; hinged front with full length stainless steel piano hinge and tumbler lock; minimum 500 seat cover capacity; for nominal 4 in (100 mm) wall depth.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-301.

2.13 MOP AND BROOM HOLDERS

A. Drawing Designation P1 - Surface-Mounted Mop and Broom Holder with Utility Shelf:

1. Description: Fabricated of stainless steel, minimum 0.050 in (1.25 mm) (18 gage) thick shelf with returned edges, and support brackets for wall mounting; with three 0.0625 in (1.6 mm) (16 gage) stainless steel rag hooks on front of shelf, together with four spring-loaded, rubber hat, cam-type mop/broom holders; 1/4 in (6 mm) diameter stainless steel drying rod suspended beneath shelf; 36 in (900 mm) long.
2. Basis of Design: Bobrick Washroom Equipment, Inc.; Model B-224 X 36.

2.14 MIRRORS

A. Drawing Designation R1 - Surface-Mounted Stainless Steel Framed Mirror (without Shelf):

1. Description: Fabricated of stainless steel; exposed frame with angle shapes not less than 0.050 in (1.25 mm) (18 gage) thick, with square corners mitered, welded, and ground smooth, and to accommodate glass edge protection material; with galvanized steel backing sheet, minimum 0.034 in (0.8 mm) (22 gage) in thick and full mirror size, with non-absorptive filler material (corrugated cardboard not acceptable), and with hanging brackets; glass mirror.
2. Basis of Design: Bobrick Washroom Equipment, Inc.; Model B-290 2436.

B. Drawing Designation S1 - Unframed Mirror: Refer to Division 08 Section "Mirrors".

2.15 ROBE HOOKS

A. Drawing Designation V1 - Surface-Mounted Single Robe Hook:

1. Description: Fabricated of stainless steel; rectangular profiled pin welded to backplate, with cover anchored with set-screws; project nominal 1-1/2 in (38 mm) from wall surface.
2. Basis of Design: Bobrick Washroom Equipment, Inc.; Model B-76717.

B. Drawing Designation V2 - Surface-Mounted Double Robe Hook:

1. Description: Fabricated of stainless steel; rectangular profiled pin welded to backplate, with cover anchored with set-screws; project nominal 2 in (50 mm) from wall surface.
2. Basis of Design: Bobrick Washroom Equipment, Inc.; Model B-76727.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, install toilet accessories according to the following, unless otherwise specified in this Section:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. General Requirements: Install toilet accessories level, plumb, and firmly anchored in locations and at heights indicated. Use fasteners that are appropriate to substrate indicated and as recommended by respective product manufacturer.

B. Grab Bars: Install to withstand downward load of minimum 250 lbf (1.10 kN) according to ASTM F 446.

C. Mirrors: Secure to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws.

END OF SECTION

SECTION 10 4116

EMERGENCY KEY CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes emergency key cabinets and supplementary items necessary for their proper installation.

1.2 QUALITY ASSURANCE

A. Local Authority Approval: Obtain approval of local fire department for keyway access and exact location of key keeper box prior to product data submittal.

B. Key keeper will be required at entrances to the following:

1. Two (2) each as indicated on Drawing A2.01.
2. Additional building entrance(s) if designated by the fire department.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data, marked specifically to indicate compliance with these specifications.

B. Samples: 3-inch-square sample of exposed metal to indicate compliance with finish specified.

PART 2 - PRODUCTS

2.1 KEY KEEPER

A. Product Standard: Knox Co. "Knox Box" 3200 Series.

B. Size: As follows:

1. Recessed: 7 inches wide, 7 inches high, 3-1/4 inches deep.

C. Finish: Manufacturer's standard weather resistant polyester powder coat.

1. Color: Dark bronze.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's latest published requirements.

END OF SECTION

SECTION 10 4400

FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes fire protection specialties (fire extinguishers, cabinets, accessories) and supplementary items necessary to complete their installation.

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.

1. Fire Extinguishers: Include rating and classification.
2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Samples for Verification: For each type of exposed cabinet finish required, prepared on 6 by 6-inch-square Samples and of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. J.L. Industries, Inc.
2. Larsen's Manufacturing Co.
3. Potter-Roemer, Div. of Smith Industries Inc.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 1008/A 1008M, commercial quality, stretcher leveled, temper rolled.

2.3 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.

B. Multipurpose Dry Chemical Type - Typical (unless otherwise indicated): UL-rated 4-A:60-B:C, 10-lb nominal capacity, in enameled steel container.

2.4 FIRE-PROTECTION CABINETS

A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

B. Cabinet Type FEC-1: (Unless otherwise indicated)

1. Cabinet Metal: Enameled-steel sheet.

   a. Color: Gloss White.

2. Cabinet Type: Suitable for 10 lb. fire extinguisher.
3. Cabinet Mounting: Recessed in walls of sufficient depth to suit style of trim indicated.
4. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

   a. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

      1) Flat Trim: 1/4- to 5/16-inch backbend depth.

5. Cabinet Trim Material: Manufacturer's standard, same metal and finish as door.
6. Door Material: Manufacturer's standard, primed steel sheet.
7. Door Glazing: Manufacturer's standard, clear float glass, ASTM C 1036, Type I, Class 1, Quality q3, 6mm thick.
8. Door Style: Manufacturer's standard vertical duo panel design.
9. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected. Provide minimum 1/2-inch- thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.
10. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

C. Cabinet Type FEC-2:

1. Cabinet Metal: Enameled-steel sheet.

   a. Color: Gloss White.

2. Cabinet Type: Suitable for 10 lb. fire extinguisher:
3. Cabinet Mounting: Surface mounted cabinet with box fully exposed and mounted directly on wall.
4. Cabinet Trim Material: Manufacturer's standard, enameled steel sheet.

a. Color: Gloss Red.

5. Door Material: Manufacturer's standard, enameled steel sheet.

a. Color: Gloss Red.

6. Door Glazing: Manufacturer's standard, clear tempered break glass, ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm.
7. Door Style: Manufacturer's standard center glass panel design.
8. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.

a. Provide minimum 1/2-inch-thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.
b. Provide inside latch and lock for break-glass panels.

9. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

a. Break-Glass Strike: Provide manufacturer's standard break glass handle or metal strike, complete with chain and mounting clip, secured to cabinet.
b. Door Locks: Provide cylinder lock, with all cabinets keyed alike.

2.5 ACCESSORIES

A. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.

1. Fire Extinguisher Cabinet: Identify with the words "FIRE EXTINGUISHER" in black die cut vinyl letters applied to glass.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 STEEL FINISHES

A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling". After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

B. Factory Prime Finish: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive fire extinguishers, cabinets and associated work and conditions under which work will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing fire-protection specialties.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
2. Fasten cabinets to structure, square and plumb.

C. Field painting of FEC-1 is included in Division 09 Section "Painting".

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Material Completion.

END OF SECTION

SECTION 10 5113

METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this Section includes metal lockers and supplementary items necessary to complete their installation.

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of locker and bench.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work. Show locker fillers, trim, base, tops, and accessories. Include locker-numbering sequence.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

D. Samples for Verification: For each locker color selected, in manufacturer's standard size samples, but not less than 4-inch-square, showing the full range of color, texture, and pattern variations expected. Prepare Samples from the same material to be used for the Work.

E. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals specified in Division 01.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain locker units and accessories through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Art Metal Products.
2. De Bourgh Manufacturing Co.
3. List Industries Inc.
4. Lyon Metal Products Inc.
5. Penco Products.
6. Republic Storage Systems Co., Inc.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 366, matte finish, suitable for exposed applications, and stretcher leveled or roller leveled to stretcher-leveled flatness.

B. Fasteners: Zinc- or nickel-plated steel, slotless-type exposed bolt heads, and self-locking nuts or lock washers for nuts on moving parts.

2.3 WARDROBE LOCKERS

A. Body: Form backs, tops, bottoms, sides, and intermediate partitions from 0.0239 inch (24 gage) minimum steel sheet; flanged for double thickness at back vertical corners.

B. Frames: Form channel frames from minimum 0.0598-inch-thick steel sheet; lapped and welded at corners. Form continuous integral door strike on vertical frame members. Provide resilient bumpers to cushion door closing.

1. Latch Hooks: Form from minimum 0.1046-inch-thick steel; welded or riveted to door frames.
2. Cross Frames: Form intermediate channel cross frames between tiers from minimum 0.0598-inch- (1.50-mm-) thick steel sheet. Weld to vertical frame members.

C. Doors: One-piece 0.0598 inch (16 gage) minimum steel sheet, formed into channel shape at vertical edges and flanged at right angles at top and bottom edges. Fabricate to prevent springing when opening or closing, and to swing 180 degrees.

1. Reinforcement: Brace or reinforce inner face of doors more than 15 inches wide.
2. Acoustical Treatment: Fabricate lockers for quiet operation with manufacturer's standard rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact.
3. Louvered Vents: Stamped, louvered vents in door face, as follows:

a. Multiple-Tier Lockers: No fewer than two louver openings at top and bottom, or three louver openings at top or bottom.

D. Shelves: Provide hat shelf in single-tier units; fabricated from minimum 0.0239-inch-thick, formed steel sheet; flanged on all edges.

E. Hinges: Steel, full loop, five or seven knuckle; tight pin; minimum 2 inches high. Weld to inside of door frame and attach to door with at least two factory-installed fasteners that are completely concealed and tamper resistant when door is closed.

1. Provide at least three hinges for each door more than 42 inches high and at least two hinges for each door 42 inches high or less.

F. Recessed Handle and Latch: Manufacturer's standard housing, formed from 0.0359-inch-thick nickel-plated steel or stainless steel, with integral door pull, recessed for latch lifter and locking devices; nonprotruding latch lifter; and automatic, prelocking, pry-resistant latch, as follows:

1. Provide minimum three-point latching for each door more than 42 inches high; minimum two-point latching for each door 42 inches high or less.

a. Provide strike and eye for padlock.

2.4 LOCKER ACCESSORIES

A. Interior Equipment: Furnish each locker with the following items, unless otherwise indicated:

1. Hooks: Manufacturer's standard zinc-plated, ball-pointed steel. Provide one double-prong ceiling hook, and not fewer than two single-prong wall hooks for single-, double-, and triple-tier units. Attach hooks with at least two fasteners.
2. Coat Rods: Manufacturer's standard galvanized steel. Provide rod in lieu of ceiling hook for lockers 18 inches deep or greater.

B. Number Plates: Manufacturer's standard etched, embossed, or stamped, aluminum number plates with numerals at least 3/8-inch-high. Number lockers in sequence indicated. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

C. Continuous Metal Base: Minimum 0.0598-inch- (16 gage) thick steel sheet, 4-inch-high channel or zee profiled for stiffness, fabricated in lengths as long as practicable to enclose base and base ends of lockers, and finished to match lockers.

D. Continuously Sloping Tops: Manufacturer's standard, fabricated from minimum 0.0359-inch- (20 gage) thick steel sheet, for installation over lockers with separate flat tops. Fabricate tops in lengths as long as practicable, without visible fasteners at splice locations, finished to match lockers. Provide fasteners, filler plates, supports, and vertical end closures.

E. Finished End Panels: Manufacturer's standard; fabricated from minimum 0.0239-inch- (24 gage) thick steel sheet, finished to match lockers, and designed for concealing exposed ends of nonrecessed lockers.

2.5 FABRICATION

A. Unit Principle: Fabricate each locker with an individual door and frame, individual top, bottom, back, and shelves, and common intermediate uprights separating compartments.

B. Knocked-Down Construction: Fabricate lockers for nominal assembly at Project site.

C. Fabricate lockers square, rigid, and without warp, with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch. Weld frame members together to form a rigid, one-piece assembly.

1. Form locker-body panels, doors, shelves and accessories from one-piece steel sheet, unless otherwise indicated.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.

B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-enamel finish consisting of a thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 1.4 mils on doors, frames, and legs, and 1.1 mils elsewhere.

1. Color and Gloss: As selected by Architect from manufacturer's full range of standard colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive metal lockers and associated work and conditions under which lockers will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 INSTALLATION

A. Install metal lockers and accessories level, plumb, rigid, and flush according to manufacturer's written instructions.

B. Assemble knocked-down lockers with standard fasteners, with no exposed fasteners on door faces and face frames.

C. Anchor lockers to floors and walls at intervals recommended by manufacturer, but not more than 36 inches o.c. Install anchors through backup reinforcing plates where necessary to avoid metal distortion, using concealed fasteners.

D. Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach sloping top units to lockers, with closures at exposed ends.
2. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed lockers.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

B. Clean interior and exposed exterior surfaces and polish stainless-steel and nonferrous-metal surfaces.

C. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit locker use during construction.

D. Touch up marred finishes, or replace locker units that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

SECTION 10 7500

FLAGPOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes flagpoles and supplementary items necessary to complete work required for their installation.

1.2 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product data and installation instructions for each type of flagpole required.

C. Shop drawings of flagpoles and bases, showing general layout, jointing, grounding method, and anchoring and supporting systems. Include details of foundation system for ground-set poles.

D. Samples of each finished metal for flagpoles and accessories as requested by Architect.

1.3 QUALITY ASSURANCE

A. Manufacturing Standards: Provide each flagpole as a complete unit produced by a single manufacturer, including fittings, accessories, bases, and foundations, anchorage devices.

B. Design Criteria: Provide flagpoles and installations constructed to withstand wind velocity minimum when flying flag of appropriate size. Use heavy pipe sizes if required for flagpole type and height shown.

1. Design flagpoles in accordance with ANSI/NAAMM FP 1001.
2. Flag size shall be as recommended by NAAMM "Flagpole Manual".

C. Pole Construction: Construct pole and ship to site in one piece if possible. If more than one piece is necessary, provide snug-fitting, precision joints with self-aligning, internal splicing sleeve arrangement for weather-tight, hairline field joints.

1.4 DELIVERY, STORAGE, AND HANDLING

A. General: Spiral wrap flagpoles with heavy Kraft paper or other weather-tight wrapping and prepare for shipment in hard fiber tube or other protective container.

B. Deliver flagpoles and accessories completely identified for installation procedure. Handle and store flagpoles to prevent damage or soiling.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Aabec Pole Div., Morgan-Francis Co.
2. Adams Flagpole Div. of Morgan Products Inc.
3. American Flagpole Div. of Kearney-National, Inc.
4. Concord Industries, Inc.
5. EMC Div., Eder Manufacturing Corp.
6. Eder Flag Manufacturing Co., Inc.
7. John Ewing and Co., Inc.
8. Pole-Tech, Inc.

2.2 FLAGPOLE TYPE

A. Aluminum Flagpoles: Fabricate from seamless extruded tubing complying with ASTM B 241, alloy 6063-T6, having a minimum wall thickness of 3/16 inch (0.1875 inch), tensile strength not less than 30,000 psi, and a yield point of 25,000 psi. Heat-treat and age-harden after fabrication.

1. Provide cone-tapered aluminum flagpoles.

2.3 FLAGPOLE MOUNTING

A. Provide manufacturer's standard base system for the type of flagpole installation required.

B. Foundation Tube: For ground-set flagpoles, provide 16-gage minimum galvanized corrugated steel tube, or 12-gage rolled steel tube, sized to suit flagpole and installation. Furnish complete with welded steel bottom base and support plate, lightning ground spike, and steel centering wedges, all welded construction. Provide loose hardwood wedges at top for plumbing pole after erection. Galvanize steel parts after assembly, including foundation tube.

1. Provide manufacturer's standard flash collar, finished to match flagpole.

2.4 SHAFT FINISH

A. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Aluminum: Finish designations prefixed by "AA" conform to the Aluminum Association system for designating aluminum finishes. Provide fine, directional, medium satin polish (AA-M32), finished as follows:
1. Natural clear anodized finish complying with AA-C22A41, Class I (0.7 mil).

2.5 FITTINGS

A. Finial Ball: Manufacturer's standard flush-seam ball, size as indicated or, if not indicated, to match pole butt diameter.

1. 14 gage spun aluminum with gold anodized finish.

B. Exterior Halyard System:

1. Truck: Ball-bearing, nonfouling, revolving, double-track assembly of cast metal finished to match pole shaft.
2. Cleats: Two 9-inch cast metal cleats with fasteners, finished to match pole shaft.
3. Halyards: Provide two polypropylene, braided, white continuous halyards for each flagpole.

C. Halyard Flag Snaps: Provide two bronze swivel snaps per halyard.

PART 3 - EXECUTION

3.1 PREPARATION FOR GROUND-SET POLES

A. Excavation: Excavate for foundation concrete to neat clean lines in undisturbed soil. Provide forms where required due to unstable soil conditions. Remove wood, loose soil, rubbish, and other foreign matter from excavation; and moisten earth before placing concrete. Back fill open excavation after concreting with original excavated material.

B. Concrete: Provide concrete composed of portland cement, coarse and fine aggregate, and water mixed in proportions to attain 28-day compressive strength of not less than 3000 psi, complying with ASTM C 94.

C. Place concrete immediately after mixing. Compact concrete in place by use of vibrators. Moist-cure exposed concrete for not less than 7 days, or use a nonstaining curing compound in cold weather.

D. Finish trowel exposed concrete surfaces to smooth, dense surface. Provide positive slope for water runoff to base perimeter.

3.2 FLAGPOLE INSTALLATION

A. General: Prepare and install flagpoles where shown and in compliance with accepted shop drawings and manufacturer's instructions.

1. Provide positive lightning ground for each flagpole installation.
2. Paint below-grade portions of ground-set flagpole with heavy coat of bituminous paint.

END OF SECTION

SECTION 11 5215

T.V. SUPPORT BRACKETS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this Section includes T.V. support brackets and supplementary items necessary to complete their installation.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's specifications to evidence compliance with these specifications, and technical literature indicating product characteristics and installation instructions.

B. Warranty: Furnish manufacturer's standard warranty for five years from Date of Material Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Bretford Manufacturing, Inc.
2. Da-Lite Screen Co.
3. Lucasey Mounting Systems.
4. Peerless Sales, Inc.

2.2 PRODUCT STANDARD

A. The Contract Documents are based on the following product to establish a standard of quality. Other acceptable manufacturer's with products having equivalent characteristics may be considered provided deviations are minor and do not change the intended aesthetic, functional and performance requirements as judged by the Architect.

1. Basis-of-Design: Peerless Industries, Inc.
2. TVM-1: T.V. Mount - Surface.

    a. Model: ST16D for 22 to 71-inch-monitor.
    b. Tilting: +15 / -5 degrees continuous tilt.
    c. Locking: Incremental tilt locking.
    d. Capacity: Up to 200 lbs.
    e. Color: Black.
    f. Mounting: Surface.
    g. Adapter Accommodation: Fits any PLP adapter plate.

3. TVM-2: T.V. Mount – Swivel.

   a. Model: IM740P for 22 inch to 40-inch-monitor.
   b. Movement:

      1) Tilt: + 15 / -5 degrees.
      2) Swivel: +/- 45 degrees.
      3) Roll: +/- 5 degrees.

   c. Locking: N/A.
   d. Capacity: Up to 80 lbs.
   e. Color: Black.
   f. Mounting: Fully recessed.
   g. Adapter Accommodation: Fits any PLP adapter plate

2.3 ACCESSORIES

A. Anchorage Devices: Provide anchors of material, type and finish (exposed finish shall match adjacent product finish) required to properly anchor or attach brackets to the substrate indicated.

B. Anchorage shall be sufficient to support the products and shall utilize a factor of safety of 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive T.V. brackets and associated work and conditions under which work will be installed. Do not proceed until unsatisfactory conditions have been corrected in a manner complying with the Contract Documents and acceptable to the Installer. Starting of work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's requirements, approved submittals and Contract Documents.

END OF SECTION

SECTION 12 2413

ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes roller window shades and supplementary items necessary to complete their installation.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

B. Shop Drawings: Show location and extent of roller window shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other Work, operational clearances, and relationship to adjoining work.

C. Samples for Verification:

1. Full Size Unit: Complete, full-size operating unit not less than 16 inches wide for each type of roller shade indicated.
2. Shade Material: Not less than 6 inches square, with specified treatments applied. Mark face of material.
3. Valance: Full-size unit, not less than 12 inches long.

D. Window Treatment Schedule: Include roller window shades in schedule using same room designations indicated on Drawings.

E. Maintenance Data: For roller window shades to include in maintenance manuals. Include the following:

1. Methods for maintaining roller window shades and finishes.
2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
3. Operating hardware.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed installation of roller window shades similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations: Obtain roller window shades through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Resistance Ratings: Passes NFPA 701.

D. Mock-ups: Build mock-ups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Build mock-ups of the size indicated or, if not indicated, one typical window shade of each type.
2. Approved mock-ups may become part of the completed Work if undisturbed at time of Material Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in a window treatment schedule.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install roller window shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller window shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Rollers Shades: Before installation begins, for each size, color, texture, and pattern indicated, full-size units equal to 5 percent of amount installed, but not fewer than 2 units.

1.7 WARRANTY

A. Special Warranty: Provide manufacturer's standard written warranty agreeing to repair or replace components of the roller window shades that fail in material or workmanship within specified warranty period. Fabric failure includes deterioration, sag, warp, fade or will not remain fit for use.

1. Manual operating components: 10 years.
2. Shade Cloth: 10 years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Draper Shade & Screen Co., Inc.
2. Hunter Douglas Window Fashions.
3. MechoShade Systems, Inc.

B. Product Standard: Mecho Shade System, Inc.

1. Manual Operation: Mecho/5.
2. Shadecloth: Refer to Finish Legend.

2.2 ROLLER WINDOW SHADES

A. Shade Band Material: PVC-coated polyester.

B. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with manufacturer's standard method for attaching shade material.

C. Direction of Roll: Regular, from back of roller.

D. Mounting Brackets: Galvanized or zinc-plated steel.

E. Fascia: L-shaped, extruded aluminum; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; removable design for access.

F. Bottom Bar: Steel or extruded aluminum, with plastic or metal capped ends. Provide exposed-to-view, external-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.

G. Shade Operation: Manual with continuous loop bead chain lift operator.

1. Clutch: Capacity to lift size and weight of shade; sized to fit roller or provide adaptor.
2. Loop Length: Length required to make operation convenient from floor level.
3. Bead Chain: Stainless steel.
4. Operating Function: Stop and hold shade at any position in ascending or descending travel.

2.3 ROLLER SHADE FABRICATION

A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.

B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Lifting Mechanism: With permanently lubricated moving parts.

C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F.

1. Shade Units Installed Between (Inside) Jambs: Edge of shade not more than 1/2 inch from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.

D. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting fascia or headbox, roller, and operating hardware and for hardware position and shade mounting method indicated.

E. Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

F. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness. Color as selected.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances and other conditions affecting performance.

B. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 ROLLER SHADE INSTALLATION

A. Install roller window shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Set shades to stop 1-1/2 inches above sill.

3.3 ADJUSTING

A. Adjust and balance roller window shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller window shades are without damage or deterioration at time of Material Completion.

C. Replace damaged roller window shades that cannot be repaired, in a manner approved by Architect, before time of Material Completion.

END OF SECTION

SECTION 12 3660

SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes solid surfacing countertops and bases and supplementary items necessary to complete their installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's specifications and literature to evidence compliance with these specifications.

B. LEED Submittals:

1. Product Data for Credit EQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.
2. Product Data for Credit MR 4.1 and MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

C. Shop Drawings: Show dimensioned plans and elevations, large-scale details, attachment devices, and other components. Show locations and sizes of cutouts and holes for plumbing fixtures, accessories and other items installed in countertops.

D. Samples for Verification: For solid-surfacing material, 6 inches square, showing color and pattern selected.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed countertops similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Fabricator Qualifications: A firm experienced in producing countertops similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fire-Test-Response Characteristics: Provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabrication without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.5 WARRANTY

A. Special Warranty: Submit written warranty on labor and material executed by manufacturer, covering failure of solid surfacing countertops within warranty period. This warranty shall be in addition to, and not limitation of, other rights Owner may have against Contractor under Contract Documents.

1. Warranty period for solid surfacing countertops is 10 years after date of Material Completion.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOPS

A. Configuration: Provide countertops with the following front and backsplash style:

1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.
3. Endsplash: Matching backsplash.

B. Countertops: 1/2-inch- (12.7-mm-) thick, quartz agglomerate with front edge built up with same material.

C. Backsplashes: 1/2-inch- (12.7-mm-) thick, quartz agglomerate.

D. Fabrication: Fabricate tops in one piece with shop-applied edges unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

2.2 COUNTERTOP MATERIALS

A. Adhesives: Do not use adhesives that contain urea formaldehyde.

B. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with the "Physical Characteristics of Materials" Article of ANSI SS1.

1. Colors and Patterns: As indicated in Finish Legend.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive solid surfacing countertops and associated work and conditions under which work will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 PREPARATION

A. Prepare substrate surfaces to insure adequate installation, in accordance with the Contract Documents and approved Shop Drawings, or manufacturer's requirements.

B. Protect adjacent areas or surfaces from damage as a result of the work of this Section.

3.3 INSTALLATION

A. Install in accordance with manufacturer's latest published requirements, specifications, details and approved Shop Drawings.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
2. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
3. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
4. Secure backsplashes to tops and walls with adhesive.
5. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants".

B. Attachment: Secure countertop to sub framing supports with silicone adhesive in accordance with manufacturer's recommendations.

C. Solid Surfacing Joints: Prepare ends and edges of pieces to be joined according to the manufacturer's recommendations for position and angle of butted joint. Lightly sand and thoroughly clean to remove dirt and grease. Join pieces with adhesive clamped until fully cured. Buff and sand to produce a smooth uniform seamless surface.

D. Joints to Other Substrates: Apply sealant and compress to form bond with surfaces and tool sealant surface to clean, straight lines.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 14 2400

HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes hydraulic passenger elevators and supplementary items necessary to complete their installation.

B. Refer to Division 05 Section "Structural Steel Framing" for attachment plates, angle brackets and divider beams for fastening guide-rail brackets.

C. Refer to Division 05 Section "Metal Fabrications" for Structural-steel shapes for subsills and pit ladders.

D. Division 28 Sections for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts and machine rooms to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.

E. Refer to Division 26 Sections for electrical service for elevators to and including fused disconnect switches at machine room door and standby power source, transfer switch, and connection from auxiliary contacts in transfer switch to controller.

1.2 DEFINITIONS

A. Defective Elevator Work: Operation or control system failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

1.3 DOCUMENT VERIFICATION

A. In order to discover and resolve conflicts or lack of definition which might create problems, elevator manufacturer must review contract documents for compatibility with its product prior to bidding. Review structural, architectural, electrical, mechanical documents, and elevator specification.

B. Submit specific, written exception and/or clarification with quotation. Compliance with provisions of contract documents is assumed and required in absence of written exception.

C. Owner will not pay for change to structural, mechanical, electrical, or other systems required to accommodate manufacturer's equipment if not identified before contract award.

1.4 SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information.

B. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment and signals. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples: For exposed finishes of cars, hoistway doors and frames, and signal equipment; 3-inch-square samples of sheet materials; and 4-inch-lengths of running trim members.

D. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

E. Maintenance Manuals: Include operation and maintenance instructions, parts listing with sources indicated, recommended parts inventory listing, emergency instructions, and similar information.

F. Diagnostic Test Equipment and Instructions: Provide all diagnostic test devices together with one set of all supporting information necessary for interpretation of test data and troubleshooting of system. The elevator installation shall be a design that can be maintainable by any licensed elevator maintenance company employing journeymen mechanics, without the need to purchase or lease additional diagnostic devices, special tools, or instructions from the original equipment manufacturer.

G. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an experienced installer approved by elevator manufacturer who has completed elevator installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Regulatory Requirements: In addition to local governing regulations, comply with applicable provisions in ASME A17.1, "Safety Code for Elevators and Escalators."

1. Seismic Risk Zone: Comply with Code requirements for seismic risk zone indicated under "Building Summary" on Drawings.

C. Accessibility Requirements: In addition to local governing regulations, comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)."

1.6 COORDINATION

A. Coordinate installation of sleeves, block outs, and items that are embedded in concrete or masonry for elevator equipment. Furnish templates and installation instructions and deliver to Project site in time for installation.

B. Coordinate locations and dimensions of other work relating to hydraulic elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; and electrical service, electrical outlets, lights, and switches in pits and machine rooms.

1.7 WARRANTY

A. Special Manufacturer's Warranty: Written warranty, signed by manufacturer agreeing to repair, restore, or replace defective elevator work within specified warranty period.

1. Warranty Period: 12 months from date of Material Completion.

1.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Material Completion, provide 12 months' full maintenance service by skilled employees of the elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Provide parts and supplies as used in the manufacture and installation of original equipment.

1. Perform maintenance, including emergency callback service, during normal working hours with two hour or less response time.
2. Include 24-hour-per-day, 7-day-per-week emergency callback service with one hour or less response time.

B. Continuing Maintenance Proposal: Provide a continuing maintenance proposal from Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Fujitec America, Inc.
2. KONE Inc.
3. Otis Elevator Co.
4. Schindler Elevator Corp.
5. Thyssen Krupp Elevator.

2.2 MATERIALS AND COMPONENTS

A. General: Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components, published by manufacturer as included in standard preengineered elevator systems and as required for a complete system.

B. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations. Provide the following:

1. Submersible pump, with submersible squirrel-cage induction motor, suspended inside tank from vibration isolation mounts.
2. Provide motor with wye-delta starting.

C. Hydraulic Silencers: Provide hydraulic silencer containing pulsation-absorbing material in a blowout-proof housing at pump unit.

D. Piping: Provide size, type, and weight piping recommended by manufacturer, and provide flexible connectors to minimize sound and vibration transmissions from power unit.

1. Provide dielectric couplings at plunger/cylinder units.
2. Casing for Underground Piping: PVC pipe complying with ASTM D 1785 joined with PVC fittings complying with ASTM D 2466 and solvent cement complying with ASTM D 2564.

E. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work where installation of devices is specified in another Specification Section.

F. Protective Cylinder Casings: PVC pipe casings complying with ASME A17.1, of sufficient size to provide not less than 1-inch clearance from cylinder, and extending above pit floor.

G. Corrosion Protective Filler: A solventless, petroleum-based gel formulated for filling the space between hydraulic cylinders and protective casings. Filler is heavier than water, electrically nonconductive, and liquefies at approximately 150 deg F.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Diversified Enterprises; No-Ox-Id R-R #6110A.
b. Pacific Standard Chemical Co.; Union-Gard 160.

H. Car Frame and Platform: Welded steel units.

I. Finish Materials: Provide the following materials and finishes for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated:

1. Stainless Steel: ASTM A 666, Type 304, finish as scheduled.
2. Aluminum: Extrusions per ASTM B 221; sheet and plate per ASTM B 209.

2.3 OPERATION SYSTEMS

A. Passenger Elevators: Provide manufacturer's standard microprocessor operation system for each elevator or group of elevators as required to provide type of operation system indicated.

1. Single Elevator: Provide "selective collective automatic operation" as defined in ASME A17.1.

B. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators indicated.

1. Loaded-Car Bypass: When car load exceeds a predetermined weight, car will respond only to car calls, not to hall calls. Predetermined weight can be adjusted.
2. Automatic Dispatching of Loaded Car: When car load exceeds a predetermined weight, doors will begin closing.
3. Special Emergency Control – Firefighter's Service: Provide Phase I and Phase II Firefighter's Service in conformance with current ASME A17.1 and local building code.

C. Electrical Wiring:

1. Furnish and install complete insulated wiring to connect all parts of the equipment. Properly ground all components as required by National Electric Code.
2. Provide 15 percent spare wires between each controller, selector, hoistway junction box, and control panel; also provide 15 percent spare conductors in each trail cable; all spares shall be properly tagged or otherwise identified with clear and indelible markings.

3. Provide a total of twelve (12) shielded pairs for communication and security use in the traveling cables for each elevator. The shielded pairs shall be located in a cable which is not used to carry alternating current circuits. The shielded wiring shall extend to a junction box in the elevator controllers in machine room.

2.4 SIGNAL EQUIPMENT

A. General: Provide signal equipment for each elevator or group of elevators with hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements of acrylic or other permanent, nonyellowing translucent plastic.

B. Swing-Return Car Control Stations: Provide car control stations fully recessed in hinged return panel adjacent to car door.

1. Include call buttons for each landing served and other buttons, switches, and controls required for specified car operation.
2. Mark buttons and switches with manufacturer's standard identification for required use or function that complies with ASME A17.1.
3. Mount controls at heights complying with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)."
4. Provide two car control stations in each elevator with front and rear doors; locating one station at each door; equip only one with required keyswitches.

C. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Fire Department Communication System: Provide flush-mounted cabinet in each car and required conductors in traveling cable for fire department communication system specified in Division 27 Sections.

E. Car Position Indicator: Provide illuminated-signal type, digital-display type, or segmented type, located above car door or above car control station. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car control station.

F. Hall Push-Button Stations: Provide one hall push-button station at each landing for each elevator or group of elevators, but not less than one station for each three elevators in a group. For each group of passenger elevators, locate between two elevators at center of group or at location most convenient for approaching passengers.

1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
2. Provide units with direction-indicating buttons; two buttons at intermediate landings; one button at terminal landings.

G. Hall Lanterns: Provide units with illuminated arrows, but provide single arrow at terminal landings.

1. Provide units with flat faceplate for mounting with body of unit recessed in wall and with illuminated elements projecting from faceplate for ease of angular viewing.

2. Place lanterns either above or beside each hoistway entrance, unless otherwise indicated. Mount at a minimum of 72 inches above finished floor.
3. With each lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

H. Hall Position Indicators: Provide illuminated-signal type or digital-display type, located above each hoistway entrance at ground floor. Provide units with flat faceplate for mounting with body of unit recessed in wall.

2.5 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening devices with a uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams shall cause doors to stop and reopen.

1. Nudging Feature: After car doors are prevented from closing for a predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.6 CAR ENCLOSURES

A. General: Provide manufacturer's standard enameled-steel car enclosures with removable wall panels, suspended ceiling, trim, accessories, access doors, doors, automatic door operators, sills (thresholds), lighting, and ventilation.

1. Fabricate car with recesses and cutouts for signal equipment.
2. Fabricate car door frame integrally with front wall of car.
3. Doors: Flush, hollow-metal construction.
4. Sills: Extruded metal, with grooved surface, 1/4-inch-thick.
5. Refer to elevator schedule at the end of this Section for exposed finishes.

2.7 HOISTWAY ENTRANCES

A. General: Provide manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Provide frame size and profile to coordinate with hoistway wall construction.

1. Where gypsum board wall construction is indicated, provide self-supporting frames with reinforced head sections.
2. Frames: Formed metal sheet, minimum 14 gage.
3. Doors: Flush, hollow-metal construction minimum 16 gage.
4. Provide raised floor numerals and Braille to meet ADA requirements on each side of door frames at each floor.
5. Sills: Extruded metal, with grooved surface, 1/4-inch-thick.
6. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
7. Refer to elevator schedule at the end of this Section for exposed finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Verify critical dimensions, and examine supporting structure and other conditions under which elevator work is to be installed. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with referenced standard and manufacturer's instructions and recommendations for work required during installation.

B. Excavation for Jack: Drill excavation in each elevator pit to accommodate installation of protective casings and cylinders.

1. Provide waterproof well casings as necessary to retain walls of well hole.

C. Install cylinders in protective casings within well hole or casing. Before installing protective casing, remove water and debris from well hole or casing and provide permanent waterproof seal at bottom of well casing. Fill void space between protective casing and cylinder with corrosion-protective filler.

1. Align cylinders and fill space between well casing and protective casing with fine sand unless otherwise required by authorities having jurisdiction.

D. Install cylinders plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor. Seal between protective casing and pit floor with 4 inches of nonshrink, nonmetallic grout.

E. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

F. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to effectively prevent transmission of vibrations to structure and thereby eliminate sources of structure-borne noise from elevator system.

G. Install piping above the floor, where possible. Where not possible, install underground piping in Schedule 40 PVC pipe casing assembled with solvent-cement fittings.

H. Lubricate operating parts of systems as recommended by manufacturers.

I. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

J. Leveling Tolerance: 1/4 inch, up or down, regardless of load and direction of travel.

K. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies.

B. Advise Owner and Architect in advance of dates and times tests are to be performed on elevators.

3.4 DEMONSTRATION

A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of operational failure and other building emergencies. Train Owner's personnel in procedures to follow in identifying sources of operational failures or malfunctions. Confer with Owner on requirements for a complete elevator maintenance program.

B. Make a final check of each elevator operation with Owner's personnel present and before date of Material Completion. Determine that operation systems and devices are functioning properly.

3.5 PROTECTION

A. Temporary Use: Do not use elevators for construction purposes unless cars are provided with temporary enclosures, either within finished cars or in place of finished cars, to protect finishes from damage.

1. Provide full maintenance service by skilled, competent employees of elevator Installer for elevators used for construction purposes. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Use same parts and supplies as used in the manufacture and installation of original equipment.
2. Provide protective coverings, barriers, devices, signs, and other procedures to protect elevators. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.6 ELEVATOR SCHEDULE

A. Elevator:

1. Function: Passenger.
2. Type: Under-the-car single cylinder.
3. Rated Load: 3500 lb.
4. Rated Speed: 150 fpm.
5. Operation System: Single Car, Selective collective automatic operation.
6. Auxiliary Operations:

    a. Loaded-car bypass.
    b. Automatic dispatching of loaded car.
    c. Firefighter's Service Phase I and II.

7. Car Enclosures: As follows:

    a. Inside Width: 80 inches.
    b. Inside Depth: 65 inches.

c. Inside Height: 115 inches.
d. Front Walls: Stainless steel, Satin No. 4 Finish with integral car door frames.
e. Car Fixtures: Stainless steel, Satin No. 4 finish.
f. Side and Rear Wall Panels: Satin No. 4 stainless steel.
g. Reveals: Stainless steel, Satin No. 4 finish.
h. Door Faces (Interior): Stainless steel, Satin No. 4 finish.
i. Door Sills: Aluminum.
j. Ceiling: Luminous ceiling.
k. Handrails: Stainless steel, Satin No. 4 finish, at side walls.
l. Floor recessed and prepared to receive ceramic tile (specified in Division 09 Section "Tiling"). Provide cementitious backer units applied over 5/8-inch underlayment grade, exterior plywood, screwed to car platform.

8. Hoistway Entrances: As follows:

a. Width: 42 inches.
b. Height: 84 inches.
c. Type: Single-speed center opening.
d. Frames: Stainless steel, Satin No. 4 finish.
e. Doors: Stainless steel, Satin No. 4 finish.
f. Sills: Aluminum.

9. Hall Fixtures: Stainless steel, Satin No. 4 finish.
10. Additional Requirements: As follows:

a. Provide inspection certificate in each car, mounted under acrylic cover with frame finish to match car enclosure exposed metal.
b. Provide protective blanket hooks in all cars and two complete sets of full-height blankets for each car size.

END OF SECTION

SECTION 14 4500

VEHICLE LIFTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vehicle lifts including safety equipment, controls and accessories.

1.2 RELATED SECTIONS

A. Division 22 Sections: Hydraulic lines, fittings, and related accessories.

B. Division 26 Sections: Service, circuiting, wiring, and connections for power and controls.

1.3 REFERENCES

A. ALI: Automotive Lift Institute.

B. ANSI/ALI ALCTV: Safety Requirements for the Construction, Testing, and Validation of Automotive Lifts.

C. UL 201 These requirements cover garage equipment, rated not more than 600 volts, for use in accordance with the National Electrical Code, NFPA 70.

1.4 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation manual.
4. Operations manual.
5. Maintenance manual.
6. Safety manual.

B. Shop Drawings: Template drawings and load reactions for lift application.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Factory trained authorized company.
2. Company insured for completed operations of installing lift.

B. In addition to the other requirements outlined herein, the lift or lifts, shall comply with all applicable requirements of ANSI standards. "Safety Requirements for the Construction, Care and Use of Automotive Lifts" as published by the American national Standards Institute. The lift company Quality Management System shall be ISO9001 certified.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

A. Contractor/manufacturer/installer has responsibility for an extended Corrective Period for work of this Section for the period stated from date of Material Completion against deficiencies as stated in the manufacturer's standard warranty.

B. Contractor/manufacturer/installer shall promptly and without inconvenience and cost to Owner correct said deficiencies:

1. Failure due to defective materials and workmanship.

C. Contractor/manufacturer/installer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Rotary Lift, A Dover Company, which is located at: 2700 Lanier Dr. ; Madison, IN 47250; Toll Free Tel: 800-640-5438; Tel: 812-273-1622; Email: request info (lkendall@rotarylift.com); Web: www.rotarylift.com

B. Substitutions: Not permitted.

2.2 10,000 LB CAPACITY SELF-CONTAINED INGROUND TWO POST FRAME CONTACT LIFT SL210i SERIES

A. Lift Characteristics: Two 8-1/2 inches hydraulic cylinders with steel frame contained inside a 1/4 inch (6 mm) thick, low-density polymer composite housing made from 60 percent recycled material. Housing is resistant (inert) to chemicals, corrosion, and electrolysis with a liquid detection alert system. Refer to installation instructions for excavation requirements.

B. Capacity: 10,000 lbs.

C. Series: SL210-i and SL210-i-DOR.

D. Minimum Bay Requirements:

1. Floor Space: 11 feet x 24 feet.

E. Overall Width: 8 feet-11-1/2 inch.

F. Drive-Thru Clearance: 6 feet-11-3/4 inch, SL210-i.

G. Rise:

1. 2-Stage Arms With Flip-Up Adapters: 81-1/4 inches from floor level to top of adapter fully extended.

H. Finishes (Excluding Arms): Black, RAL9005.

1. All arms are yellow.

I. All Models: Inbay Electronic Controls With Pneumatic 100 psi - 120 psi Air Required, Lock Release With LDS Liquid Detection System Electric Power Unit UL201 Compliant, Over Hydraulic Cylinder Drive: All models bio-fluid compatible.

1. 4hp 208-480V 3 phase Motor 50/60Hz.

J. All lifts shall be 3rd party certified by ETL testing laboratory and labeled with the ETL/Automotive Lift Institute (ALI) label that affirms the lifts meet conformance to all applicable provisions of American National Standard ANSI/ALI ALCTV-2006 and in compliance with IBC 2003, IBC 2006 chapter 30 section 3001.2.

K. Vehicle Lift-Type 1: 2-Stage arms with flip up adapters.

1. Type SL210-i.
2. Front And Rear Arms:

a. Minimum reach 19-5/8 inches.
b. Maximum reach 42-3/8 inches.
c. Minimum adapter height 4-3/4 inches.
d. Maximum adapter height 10-1/4 inches from floor.

L. Vehicle Lift-Type 2: Drive on lift with rolling jack adapters.

1. Type SL210-i-DOR.
2. Installed with rolling jack adapters.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until supporting structures have been properly prepared.

B. If supporting structure preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

A. Install in accordance with manufacturer instructions.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Material Completion.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion
Lanier Technical College – TCSG 236
Dawsonville, Georgia

PROJECT MANUAL

Volume 2 – Divisions 15 thru 33

RELEASED FOR CONSTRUCTION

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SECTION 21 0510

GENERAL FIRE SUPPRESION REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Definitions

B. Regulatory Requirements indicating applicable Codes, Ordinances and Regulations.

C. Operating and Maintenance Manuals

D. Execution Requirements common to Division 21 systems

E. Pipe Sleeves within building

F. Pipe Sleeves in footings and foundations

G. Piping Pressure Tests.

H. Cleaning Requirements.

I. Finishing Requirements

1.2 RELATED SECTIONS

A. Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Section 01 7700 - Closeout Procedures, for additional warranty requirements.

C. Section 07 8400 - Firestopping.

D. Section 07 9200 - Joint Sealants

E. Section 09 9100 - Painting.

1.3 ALTERNATIVES

A. Refer to Section 01 0300 - Alternatives, for product alternatives affecting this Division.

1.4 DEFINITIONS

A. Manufacturers Representatives: Wherever MANUFACTURER'S REPRESENTATIVE is referred to in this division, said representative shall be regularly employed by the manufacturer to perform similar activities to those called for herein, which indicates his competence in that field of work.

B. Concealed: Where the word concealed is used in this Division, it shall mean items above ceilings, in attics, in crawl spaces, in chases, in tunnels, in cabinet work, and under counters or equipment so as to be not visible from an elevation of 5 feet at a horizontal distance of 10 feet.

C. Finished Spaces or Areas: Where finished spaces or areas are referred to in this Division, it shall mean all spaces except concealed spaces, mechanical rooms, or boiler rooms unless otherwise noted.

D. Provide: Furnish and install.

E. Diagrammatic: A drawing that shows arrangement and relations (as of parts).i.e: A diagrammatic drawing uses symbols rather than pictorial representation of pipes, ducts, conduit and other items shown and is not necessarily to scale. Arrangement, location, and sizes shown are firm.

F. Readily Accessible: Equipment, valves and other items requiring service shall be installed to be readily accessible. These items shall be available for maintenance or use in a space, through an access door from floor elevation, or above a lay-in ceiling by maintenance staff standing on a ladder no taller than the ceiling.

G. Noted, Indicated or Shown: Where the terms "Noted", "Indicated" or "Shown" are used in these specifications, the words "in the specifications or on the plans" shall be inferred.

H. Detail: Where reference is made to a Detail, the Detail shall be on the plans unless otherwise noted.

I. Specifications: Where reference is made to these specifications, it shall be inferred in this Division of specifications.

J. Notification by the Contractor, and Instructions to the Contractor: Where reference is made in these specifications to notification by or instructions given to the Contractor, it shall be inferred that the Architect shall be the instructor or shall be notified, as the case exists.

K. Division or Section Reference: Where reference is made to another Division or Section within this Division, refer to specifications table of contents for Division, Section, or Page Number.

1.5 REGULATORY REQUIREMENTS

A. Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.

B. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.

C. Jurisdiction: Where codes or guides refer jurisdiction to local governing code officials, such official in this procedure shall be the State Fire Marshal.

D. Permits: Obtain all permits, paying all fees in connection therewith. At completion, have work inspected by proper authorities and furnish the Architect for the Owner an inspection certificate showing approval of installation.

E. Fire Protection: Conform to the Georgia State Minimum Standard Fire Code (International Fire Code), 2006 Edition, with 2007 and 2010 Georgia State Amendments.

F. Fire Prevention Precautions in Cutting and Welding Areas: Conform to Article 2605 Fire Prevention Precautions, Georgia State Minimum Standard Fire Prevention Code (International Fire Code), 2006 Edition, with 2007 Georgia State Amendments, for all work involving cutting and welding.

G. Energy: Conform to the Georgia State Energy Code for Buildings (International Energy Conservation Code), 2006 Edition, with 2008 and 2009 Georgia State Amendments.

H. All Work: Conform to State of Georgia Chapter 120-3-3 "Rules of Safety Fire Commissioner, Rules and Regulations, February 1, 2007", and ADA.

I. Electrical: Refer to Division 26 0000. Conform to the National Electrical Code, NFPA 70, 2008 with 2009 Georgia State Amendments.

J. Building Code: Conform to the Georgia State Minimum Standard Building Code (International Building Code), 2006 Edition with 2007, 2009, & 2010 Georgia State Amendments.

1.6 PERFORMANCE REQUIREMENTS

A. Requirements specified herein are minimum. All equipment, when installed, shall perform equal to or exceed specified requirements.

1.7 VALUE ENGINEERING

A. Where the Contractor is requested to offer or make Value Engineering suggestions as a means of reducing the Project Cost, the Contractor shall present suggestion in the format prescribed herein.

B. Provide each suggestion in writing referencing the specific element involved, ie. specification article and/or drawing/detail number(s).

C. State how the proposed change impacts the project, ie. change in life expectancy, increased operating costs, etc. in addition to the reduction of first cost (Amount of cost reduction.).

D. State how the change will impact the Construction Schedule.

E. Where the change impacts the contract drawing(s), provide a sketch of the proposed change to assist in the evaluation process. If the suggestion is approved, the Contractor shall provide a drawing, as a part of the shop drawing process, showing the Contractor's proposed changes.

F. Each suggestion shall include specific language commenting that the proposed change has been or has not been successfully made previously one or more similar projects.

1.8 SUBMITTALS

A. Supplementing Division 1 requirements; the Contractor shall:
   1. Review the submittal data and check to ensure compliance with specifications prior to submitting.
      a. The Contractor agrees that submittals of equipment and material and shop drawings of equipment and material layouts required under provisions of these specifications and processed by the Architect are not Change Orders. The purpose of submittals is to demonstrate that the Contractor understands the design concept of the project by indicating the equipment and materials he intends to furnish and install, and by detailing the installation he intends to achieve.
      b. Any submittal or shop drawing not conforming to the Contract Documents without this identification and notification shall be assumed to be marked "Revise and Resubmit" (acknowledges this by the submission), and the Contractor shall promptly resubmit said submittal so as to be in full compliance with the Contract Documents.
      c. Failure of the Contractor to provide this information during the shop drawing phase shall make the Contractor responsible for all changes to achieve compliance with the Contract Documents without additional compensation.
   2. Assemble the submittal data in compete sets in hard back three-ring binders, and bound with numbered index sheets and tabs. Submittal data shall be submitted at one time. Data shall include capacities, complete installation instructions, dimensional data and electrical data, BHP, motor HP, operating weights and load distribution at mounting points.
   3. Identify all submittals by a cover sheet showing project name, specification sections, drawing or detail number, room number, date, revision date, contractor and subcontractor's organization and project manager with phone number, the model, style and size of item being submitted with manufacturers' representative, salesman (or a preparer who can answer questions), and Preparer's phone number.
   4. Manufacturers' standard drawings shall be modified by deletions or additions to show only items applicable to this project.
   5. Prepare a master list of submittal proposed to be submitted on the project. This list shall be updated for each submission and shall be the first sheet(s) of the submission in the quantity that is submitted for review. The information and general format shall contain an Tab number, Item Description, Item Status and any comment.
   6. Provide a Letter stating that all submittals have been checked for compliance with specifications.

B. Product Data:

1. Provide data specific to the Product proposed indicating capacity data, all standard and optional features to be supplied and all accessories and options available for that product.
2. Manufacturer's standard drawings shall be modified by deletions or additions to show only items applicable to this project.

C. Warranty: Submit the Contractor's warranty letter addressed to the Owner stating the correct project name and number, if applicable, the warranty period and ensure that form has the correct date of the Final Observation.

1.9 OPERATING AND MAINTENANCE MANUALS

A. Each Manual shall be compiled as follows:
1. Data shall be bound in smooth surface hard back commercial quality three-ring notebooks with project identification shown on the front cover and binding back. Identification labels shall be typed and adhered with waterproof glue.
2. Notebooks shall have 9-1/2-inch by 11-1/2-inch covers with back width to permit the covers to lie parallel or to converge, and have not less than 1-1/2-inch back width.
3. Index divider sheets of heavy Manila paper shall be inserted between each section of the Manual with a 2-inch x 1/3-inch ready-cut shield tab attached to each sheet for identification of sections.
4. Data sheets and diagrams shall be 8-1/2-inch x 11-inch or be mounted on 8-1/2-inch x 11-inch sheets of 16-pound paper if smaller, with reinforced 11-inch mechanically perforated edges. Drawings and diagrams larger than 8-1/2-inch by 11-inch shall be folded up from the bottom to form a height of 11-inches and folded to the left to form a width of 8-1/2-inches.
5. Table of Contents(Index) sheets shall be provided in the order listed with identifications typed in capital letters.

B. Each Manual shall contain the following information, data and drawings:
1. Copies of submittals (with Engineer's review comments and stamp), equipment and materials.
2. Manufacturer's installation, operating and maintenance instructions for each item of equipment with moving parts including recommended frequency of inspections and maintenance for one years period of time.
3. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.
4. One copy of NFPA 25.
5. One Copy of as-built shop drawings showing layouts and construction details in Autocad Version 14 or later or in Microstation format.
6. One copy of hydraulic calculations.
7. Copies of all certification, test certificates, and warranties.

1.10 QUALITY ASSURANCE

A. Installer Qualifications:
1. Wherever the word "company" or "firm" is used in these subparagraphs, it shall mean the contractor/subcontractor of record for the installations used for proficiency qualification.
2. Refer to the individual sections within this division for additional installer qualification requirements.
3. Fire Protection
   a. The contractor expressly warrants that the company performing the installation of the fire protection systems has demonstrated proficiency in the installation, start-up and adjustment of such systems by the successful performance of work of the nature specified herein on at least 10 commercial or institutional buildings, each containing minimum of 10,000 ft2 of protected area or greater.
   b. The contractor further warrants that the aforesaid subcontractor, if any, has trained personnel, instruments, tools, and equipment to perform the installation specified.

c. The contractor also warrants that the aforesaid installer, if any, has been in business performing services of the nature specified herein for at least five years.
d. Provide a certificate of competency in accordance with State of Georgia Regulations, HB 1491, Act 1392, January 1, 1983.

1.11 PRODUCT DELIVERY, STORAGE, AND PROTECTION

A. Accept all products on site in factory-fabricated protective containers. Inspect for damage.

B. Store products in a clean dry place and protect from weather and construction traffic.

C. Handle products carefully to avoid damage to components, enclosures, and finish.

D. After placement, protect products from damage during construction, by all trade contractors.

E. Protect equipment nameplates and labels from damage, being painted, scaring, etc.

1.12 WARRANTY

A. Refer to Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Where extended warranties beyond the Contractor's one (1) year warranty are specified, the additional warranty time shall start at the end of the Contractor's warranty.

C. Correct defective Work for a one year period after Date of Substantial Completion.

PART 2 PRODUCTS-NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Refer to the specifications and Architectural and Structural drawings for additional requirements pertaining to work under this discipline. Notify the Architect for clarification in the event of conflict.

B. All materials of systems installation exposed in hollow spaces that are used as ducts or plenums shall have a flame spread rating of 25 or less and a smoke development rating of 50 or less.

3.2 PREPARATION

A. Drawings are diagrammatic and show the general proximity of the equipment, sprinkler heads, and pipes, etc., are not to be scaled, and do not include all required changes in direction or offsets necessary in coordinating the installation of various materials either between trades or within the same trade. All dimensions shall be verified at the building site. Prefabrication and/or installation of work from drawings shall be at the Contractor's risk. Refer to Architectural plans for exact building dimensions and details.

B. Space Conditions:
1. All apparatus shall fit into the available spaces in the building and must be introduced into the building so as not to cause damage to the structure. Equipment larger than access to equipment spaces shall be disassembled into sub-assemblies for installation.
2. Where deviations from the plans are required in order to conform to the space limitations, such changes shall be made at no additional cost to the Owner and shall be subject to approval.
3. All equipment requiring service shall be made accessible. Coordinate piping and sprinkler head installation to avoid conflict with other trades.

C. Where new work is specified tying into old work and materials are different from existing, the contractor shall request a clarification from the Architect prior to performing the work.

D. The demolition plan has been prepared to assist the contractor in determining the scope of demolition work and should not be construed to be all of the demolition required. The contractor shall visit job site (after carefully reviewing the contract documents) and determine exact areas and quantities of existing materials to be removed to accomplish new construction.

3.3 INSTALLATION

A. Clearance above and in front of electrical switchgear, electrical power panels or control panels shall be maintained by fire protection systems so that no sprinkler piping, or equipment is routed above or across the space directly above this equipment in conformance with the National Electrical Code.

B. All equipment shall be installed in accordance with manufacturers' published installation instructions shipped with the equipment. In the event there is a discrepancy between these specifications or Drawings and the manufacturers' instructions, no work shall be performed until additional instructions are received.

C. Install and connect all appliances, equipment, and appurtenances as specified, indicated or required in accordance with the manufacturer's instructions and recommendations. Furnish and install complete auxiliary piping, water seals, valves, electric connections, and similar items, recommended by the manufacturer or as required for proper operation.

D. Route piping to avoid skylights, translucent, and transparent ceilings.

E. Pipe Sleeves in Slabs, Masonry Walls and Partitions:
   1. Provide sleeves in all slabs and walls/partitions unless otherwise noted.
   2. Omit sleeves on steel pipe through slabs on grade.
   3. Elevated Slabs: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a slab.
   4. Masonry Partitions: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated masonry wall/partition.
   5. Omit sleeves in openings core drilled in masonry partitions.
   6. Rated Drywall Partitions: Twenty gage galvanized steel. Sleeves shall be sized to include the insulation with minimum gap around the insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated drywall wall/partition.
   7. Non-Rated Drywall Partitions: Omit sleeves.

F. Pipe sleeves in footings and foundation walls:
   1. Schedule 40 black steel pipe.
   2. Fire Protection water pipe, distribution piping, passing under a footing or through a foundation wall shall be installed in a pipe sleeve, two pipe sizes larger than the pipe passing through.
   3. Sleeves in walls to spaces below grade shall be provided with 10 gauge leak plates.

G. Seal sleeves and openings in mechanical room walls, fire rated partitions, and floors above grade vaportight, watertight, or for smoke/fire protection as applicable. Refer to Section 07 2250 - Firestopping

H. Seal sleeves and openings in exterior walls vaportight, or watertight as applicable. Refer to Section 07 9200, Sealants and caulking.

I. Equipment and pipe support upper attachments shall be 3" x 3" x 1/4" galvanized steel angles, minimum, spanning structural members unless noted otherwise. Provide inserts and bolts for supporting pipes and equipment from structural members.

J. Saw cut or core drill openings in existing work for the installation of the mechanical system. Patching shall be performed by the trade whose work is cut. Contractor shall lay out and install his work ahead of the work of other trades wherever possible.

3.4 PIPING PRESSURE TESTS

A. General:
1. Provide 48 hours notification to the Architect in advance of any test.
2. Complete tests prior to insulating. Leaks shall be repaired, defective materials replaced, and system shall be retested. Strike all joints in copper and steel piping under a pressure test. Conduct tests prior to connecting to equipment or isolate equipment from system.
3. No water pressure test shall be conducted in freezing weather where subject to freezing.
4. Test shall be maintained at conditions specified until approved but, in no event, for less than two (2) hours minimum duration, unless otherwise noted.
5. Hydrostatic pressure tests shall maintain pressure without change, except that due to temperature change.
6. Test pressures shall be read from a gauge located at the low elevation point of the system being tested.

B. Wet Sprinkler System:
1. Hydrostatic Test; 200 PSIG
2. Portions of the system normally subjected to working pressures in excess of 150 PSIG shall be tested at 50 PSIG higher then the normal working pressure of the system.

C. Dry Pipe and Double Interlock Systems:
1. Hydrostatic Test; 200 PSIG
2. In addition to Hydrostatic Test, an Air Pressure Leakage Test at 40 PSIG shall be conducted for 24 hours. Any leakage that results in a drop of 1.5 PSIG for 24 hours shall be corrected.
3. Where systems are installed in spaces subject to temperatures below 32 degrees F, the Air Pressure Leakage Test shall be conducted at the lowest nominal temperature of the space.

D. Water Service to Fire Protection System: Hydrostatic test, 200 PSIG.

3.5 EQUIPMENT BASES and HOUSEKEEPING PADS

A. Provide housekeeping and equipment bases as shown or listed below. Rough up slab under bases before pouring concrete.

B. Materials: Refer to Section 03 3000 - Cast-in-Place Concrete. Omit test cylinders for concrete poured under this section.

C. Bases/Pads shall be rectangular with vertical sides 4-inches from centerline of anchor bolts or 2 inches from edges of equipment supports, whichever provides the larger dimension, side of equipment or base edge, unless otherwise noted.

D. Height:
1. Pumps on Grade: 12-inch concrete base.
2. Concrete curb at all pipe penetrations of floors in mechanical rooms above grade: 4-inches or as shown on plans.

E. Chamfer: 3/4-inch on edges and corners.

F. Reinforcing: 6"x 6" 10/10 WWF at mid-depth of slab. (4 inch thick pads.)

3.6 DEMONSTRATION, TRAINING AND INSTRUCTIONS

A. Instruct operating personnel designated by the Using Agency in operation and maintenance of system prior to request for final inspection. Provide signed statement certifying instructions have been received.

3.7 CLEANING and PROTECTION

A. All materials, equipment and mechanical rooms shall be cleaned prior to Final Observation.

B. Paint equipment where finish has been damaged requiring retouching of finish to match factory finish.

C. Chipped or scraped paint shall be retouched to match original finish.

D. Clean and polish all equipment nameplates. All nameplate information shall be legible.

E. All ductwork, insulation, equipment, pipe, pipe fittings and appurtenances shall be free of dust, rust and stains prior to Final Observation.

3.8 FINISHING MECHANICAL EQUIPMENT AND MATERIAL

A. Use paint systems specified in Division 9 for the substrates to be finished.

B. Paint shop-primed equipment.

C. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

D. Paint all insulated and exposed pipes, unless otherwise indicated.

E. All ferrous fasteners and hanger supports not having a corrosion resistant plated finish shall be painted to prevent rust.

F. Paint all equipment, including that which is factory-finished, exposed to weather or to view on the roof and outdoors.

G. Paint all exposed un-insulated ferrous metals.

END OF SECTION

SECTION 21 1100

FIRE SUPPRESSION PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, fittings, valves, and connections for sprinkler systems.

1.2 RELATED SECTIONS

A. Section 21 0510 - General Fire Suppression Requirements:

B. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

C. Section 21 3000 - Fire Pumps.

1.3 REFERENCES

A. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

B. ASME B16.4 - Gray Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

C. ASME B16.5 - Pipe Flanges and Flanged Fittings; The American Society of Mechanical Engineers; 2003 (ANSI/ASME B16.5).

D. ASTM A 47/A 47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2004).

E. ASTM A 795/A 795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2004.

F. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2002.

G. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances; National Fire Protection Association 2002(; 1995).

H. NFPA 72 - National Fire Alarm Code; 2002.

I. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; 2000 with 2007 Georgia State Amendments.

J. NFPA 291 - Recommended Practice for Fire Flow Testing and Marking of Hydrants; 2002.

K. Georgia State Minimum Standard Fire Prevention Code, 2006 Edition, with 2007 and 2010 Georgia State Amendments.

L. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

M. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories Inc.; 2004.

N. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories Inc.; 2004.

O. Chapter 120-3-3 of the Rules of the Safety Fire Commissioner dated February 1, 2007.

P. Georgia State Minimum Standard Building Code (International Building Code), 2006 Edition, with 2007 and 2009 Georgia State Amendments. NFPA Code, where more stringent, shall take precedence.

1.4 SUBMITTALS

A. Refer to Section 21 0510 General Fire Suppression Requirements for submittal procedures.

B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.

C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

D. Project Record Documents: Record actual locations of components and tag numbering.

E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.5 QUALITY ASSURANCE

A. Fire Protection
   1. The Contractor expressly warrants that the company performing the installation of the fire protection systems has demonstrated proficiency in the installation, start-up and adjustment of such systems by the successful performance of work of the nature specified herein on at least 5 commercial or institutional buildings, each containing minimum of 10,000 ft2 of protected area or greater.
   2. The Contractor further warrants that the aforesaid subcontractor has trained personnel, instruments, tools, and equipment to perform the installation specified.
   3. The Contractor also warrants that the aforesaid installer has been in business performing services of the nature specified herein for at least the previous five consecutive years in the state of Georgia.
   4. Provide a certificate of competency as issued by the Georgia State Fire Marshal's Office.

B. Conform to UL and FM requirements.

C. Valves: Bear UL and FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

D. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.7 EXTRA MATERIALS

A. Provide additional materials as provided in these specifications and by NFPA..

PART 2 PRODUCTS

2.1 GENERAL SYSTEM AND PRODUCT REQUIREMENTS

A. Sprinkler Systems: Conform work to NFPA 13.

B. Welding Materials and Procedures: Conform to ASME Code.

C. Building is light hazard and ordinary hazard group 1 and 2. Pipe sizes shall be hydraulically calculated based upon contractor's flow test performed prior to construction. Flow test results at time of design: 40 PSI static, 30 PSI residual at 960 GPM flow.

D. Provide hydraulic calculations over the most remote 1500 square feet providing density required for hazard as indicated in NFPA 13. Minimum discharge pressure shall be 7.0 PSI. Minimum residual pressure at city water main in the street shall be 20.0 PSI. Provide 10.0 PSI minimum safety margin in hydraulic calculations at design point. Design area reduction per NFPA 13 is not allowed.

E. Basis of design: Flow rate above is based upon the flow test provided by Dawson County Fire Department at the main on Highway 9 North at the Adult Learning Center. Contractor shall perform, or have performed, at the same time, a Fire Flow and Twenty Four Hour Static Test to assure flow equals or exceeds specified basis of design flow rate prior to preparing shop drawings, installing system or performing calculations. Prepare calculations based on confirmed flow data or basis of design flow data, whichever is lowest. Flow test shall be performed in accordance with NFPA 13, NFPA 291, and Rules and Regulations of Safety Fire Commissioner, O.C.G.A. Chapter 120-3-3. Modify flow test pressures (static and residual), if pressure recorded in 24 hour test is lower than flow test pressures for one hour duration, to lowest hour test pressure.

F. No pipe shall be routed above electrical panels and equipment as required by National Electrical Code, on control side or beneath suspended mechanical equipment except where specifically required by Code, in which case, provisions shall be made for service access and removal.

G. Where available, piping to sprinklers in all electrical and IT rooms, shall enter over interior doors.

H. Inspectors test connection(s) shall discharge to the outside of the building in location(s) acceptable to the Architect.

I. Inside auxiliary drains, if needed, shall discharge in location(s) acceptable to the Architect.Drain and test connection piping, if in finished space, shall be installed concealed.

2.2 ABOVE GROUND WET SYSTEM PIPING

A. Steel Pipe: ASTM A 795 Schedule 10 or ASTM A 53 Schedule 40, black. Piping 2" and smaller shall be threaded. Piping 2 1/2" and larger shall be grooved with rigid couplings.
   1. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
   2. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A 47/A 47M.
   3. Mechanical Grooved Couplings: Rigid malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe. Reducing couplings and flanges are NOT allowed.

2.3 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2-inches and Over: Carbon steel, adjustable, clevis.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Vertical Support: Steel riser clamp.

E. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

F. Provide support for any vertical pipe 36" in length or greater except armovers. Provide supports 12'-0" O.C. maximum or at floor levels.

G. Threaded rods shall NOT be bent. Bending is permitted only in unthreaded sections of hanger rods. Bending shall occur as close to the hanger as possible. Provide a swivel assembly if required.

2.4 GATE VALVES

A. Up to and including 2 inches:
   1. Manufacturers:
      a. Nibco Scott; Product T-104-O
      b. Jenkins; Product 275U
      c. Hammond; Product 1B681
      d. Stockham; Product B-133
      e. Kennedy; Product Fig. 66
   2. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.

B. Over 2 inches:
   1. Manufacturers:
      a. Nibco Scott; Product F-607-OTS
      b. Crane; Product 467
      c. Jenkins; Product 825-A
      d. Hammond; Product 1R1154
      e. Stockham; Product G-634
      f. Kennedy; Product Fig. 68
   2. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid rubber covered bronze or cast iron wedge, flanged ends.

2.5 GLOBE VALVES

A. Bronze body, rubber disc, union bonnet, 174 W.W.P., threaded ends.

B. Up to and including 2 inches:
   1. Manufacturers:
      a. Nibco-Scott; Product KT-65.
      b. Kennedy; Product 97SD.
      c. United; Product 125S.
      d. Fairbanks; Product 4691-3.

2.6 ANGLE VALVES

A. Bronze body, rubber disc, union bonnet, 174 non-shock cold water, threaded ends.

B. Up to and including 2 inches:
   1. Manufacturers:
      a. Nibco-Scott; Product T-301-W.
      b. Kennedy; Product 985D.
      c. United; Product 126S.
      d. Fairbanks; Product 4691-3.

2.7 BUTTERFLY VALVES: Not allowed.

2.8 CHECK VALVES

A. Iron body, U.L. Listed- F.M. Approved, swing type, bronze trimmed, bronze seat and disc, flanged ends.

B. Manufacturers:
   1. Jenkins; Product 629
   2. Crane; Product 375
   3. Stockham; Product G-939
   4. Mueller; Product A-2120-6
   5. Kennedy; Product #126

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Storage: All piping shall be stored above ground and protected to prevent dirt and debris from entering pipe.

3.2 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13 and these specifications.

B. Install post indicator valve (PIV) upstream of backflow device.

C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

D. Install piping to conserve building space, to not interfere with use of space and other work.

E. Group piping whenever practical at common elevations.

F. All piping shall be installed above ceilings in a concealed manner except where no ceilings are present

G. Sleeve pipes passing through partitions, walls, and floors.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

I. Reducing Tees: Weld-on threaded outlet tees and Coupolet-300 by Bonney Forge Division of Energy Products Group, Central Sprink 701, "TEE-LET" 300 by Merit Manufacturing Corp., NAP300 by North Alabama Pipe Corp., F400 by Grinnell Corp. may be used for side outlet reducing tees more than two pipe sizes smaller than main. Discs shall be retrieved and connected to pipe at point of cutting. Cutting shall comply with NFPA 13, Chapter 6.5.2.9.

J. Couplings may be used on gridded systems at only one end of each gridded branch line or on 2 1/2" or larger riser nipple to 2" or smaller branch line to facilitate connection provided that the coupling is connected to piping by a cut groove. Rolled grooves are not acceptable.

K. Pipe Hangers and Supports:
   1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   2. Place hangers within 12 inches of each horizontal elbow.
   3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   4. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
   5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

L. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

M. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Refer to Section 09 9000.

N. Do not penetrate building structural members unless indicated.

O. Provide sleeves when penetrating floors and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.

P. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

Q. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.

R. Provide gate valves for shut-off or isolating service. No valve shall be installed with the centerline, if horizontal, or wheel, if vertical, more than 9'-0" AFF.

S. Provide drain valves at main shut-off valves, low points of piping and apparatus. Route drains to interior mop basins or exterior of building in locations acceptable to architect.

3.3 CLEANING AND PROTECTION

A. All materials, equipment and mechanical rooms shall be cleaned prior to the Final Observation.

B. Wash down and scrub clean all mechanical room floors, walls, equipment bases and equipment.

C. Paint equipment where finish has been damaged requiring retouching of finish to match factory finish.

D. Chipped or scraped paint shall be retouched to match original finish.

E. All dents and sags in equipment casing shall be straightened.

F. All equipment, pipe, pipe fittings and appurtenances shall be free of rust and stains prior to substantial completion.

3.4 FINISHING EQUIPMENT AND MATERIAL

A. Use paint systems specified in Division 9 for the substrates to be finished.

B. Paint shop-primed equipment and piping, in utility areas in colors according to the color coding scheme indicated.

C. Re-install electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

D. Paint all exposed pipes, unless otherwise indicated.

E. All ferrous fasteners and hanger supports not having a corrosion resistant plated finish shall be painted to prevent rust.

F. Paint all equipment, including that which is factory-finished, exposed to weather or to view on the roof and outdoors.

G. Paint all exposed un-insulated ferrous materials.

END OF SECTION

SECTION 21 1300

FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wet Type Sprinkler System

B. Dry-pipe sprinkler system.

C. System design, installation, and certification.

D. Fire department connections.

1.2 RELATED REQUIREMENTS

A. Section 28 3100 - Fire Alarm Systems.

B. Section 21 0510 - General Fire Suppression Requirements.

C. Section 21 1100 - Fire Suppression Piping.

D. Section 21 3000 - Fire Pumps.

1.3 REFERENCE STANDARDS

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.4 SUBMITTALS

A. See Section 21 0510 - General Fire Suppression Requirements, for submittal procedures.

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Shop Drawings:
1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
3. Submit shop drawings, product data, and hydraulic calculations to Fire Marshall for approval and to Architect for review. Submit to Architect prior to submitting to Fire Marshal. Submit proof of approval to the Architect.

D. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations. Provide two (2) CD and three (3) paper copies of as-built drawings. CD's shall be in Autocad release 14 or later or in microstation V8 format.

E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements. All certificates shall be signed by certificate holder.

F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

G. Maintenance Materials: Furnish the following for the Owner's use in maintenance of project.
1. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
2. Sprinkler Wrenches: For each sprinkler type.

1.5 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

B. Conform to UL requirements.

C. Equipment and Components: Provide products that bear UL label or marking.

D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

B. Store piping off floor and out of elements. Provide cover for piping to prevent dirt and debris from entering piping. Piping and fittings shall be rust free when installed.

1.7 EXTRA MATERIALS

A. Provide extra sprinklers of type and size matching those installed, in quantity required by referenced NFPA design and installation standard.

B. Provide suitable wrenches for each sprinkler type.

C. Provide metal storage cabinet located at piping entrance to building.

PART 2 PRODUCTS

2.1 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for entire building.

B. Occupancy: Light Hazard, Ordinary Hazard Group 1, and Ordinary Hazard Group 2.

C. Water Supply: Contractor shall perform or have performed an NFPA-13 water flow test and a 24 hour static pressure test. Adjust flow test to lowest pressure recorded by 24 hour test of one hour duration.

D. Interface system with building fire alarm system.

E. Provide fire department connections where indicated.

F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to Fire Pump.

2.2 SPRINKLERS

A. Tyco and affiliates, Automatic Sprinkler, Reliable, Viking.

B. All sprinklers installed shall be by the same manufacturer.

C. Contractor shall select temperature ratings in accordance with NFPA 13.

D. Extended coverage sprinklers shall not be used.

E. Suspended Ceiling Type: Semi-recessed pendant type with matching flush push on two piece escutcheon plate.
   1. Finish: Chrome plated.
   2. Escutcheon Plate Finish: Chrome plated.
   3. Fusible Link: Quick response Glass bulb type temperature rated for specific area hazard.
   4. Orifice: 1/2".

F. Gypsum Board Ceiling Type: Concealed pendant type with matching screw on escutcheon plate.

1. Finish: Enamel, color white.
2. Orifice: 1/2".

G. Exposed Area Type: Standard upright type.
1. Finish: Brass.
2. Fusible Link: Quick Response Glass bulb type temperature rated for specific area hazard.
3. Orifice: 1/2".

H. Sidewall Type: Standard horizontal sidewall type with matching flush push on two piece escutcheon plate.
1. Finish: Chrome plated.
2. Escutcheon Plate Finish: Chrome plated.
3. Fusible Link: Quick Response Glass bulb type temperature rated for specific area hazard.
4. Orifice: 1/2".

2.3 PIPING SPECIALTIES

A. Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy chrome plated gong and motor housing, nylon bearings, and inlet strainer. By same manufacturer as Alarm Valve.

B. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC. Notifier, Simplex, Potter, Grinnell.

C. Tamper Switch: Switch designed for installation on indicator valves with cased aluminum housing with red finish. Notifier, Simplex, Potter, Grinnell.

D. Fire Department Connections: Elkhart, Croker Standard, Potter Roemer.
1. Type: Free standing type with ductile iron pedestal chrome plated finish.
2. Outlets: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
3. Drain: 3/4 inch automatic drip, outside.
4. Label: "Sprinkler - Fire Department Connection".

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard and these specifications.

B. Install sprinklers where shown on contract drawings. Sprinklers in gypsum board ceilings shall be in line with and centered between down lights unless shown otherwise.

C. Install equipment in accordance with manufacturer's instructions.

D. Install buried shut-off valves in valve box. Provide post indicator.

E. Provide approved double detector check assembly at sprinkler system water source connection.

F. Locate fire department connection within forty (40'-0") feet of nearest fire hydrant and with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

G. Locate outside alarm gong on building wall at piping entrance to building.

H. Place pipe runs to minimize obstruction to other work.

I. Place piping in concealed spaces above finished ceilings.

J. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

K. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

L. Install and connect to fire pump system in accordance with Section 21 3000.

M. Flush entire piping system of foreign matter.

N. Hydrostatically test entire system. Refer to Section 21 0510.

O. Require test be witnessed by Fire Marshall, Architect or his designated representative.

P. All drain piping shall discharge to the outside 6" maximum above grade unless noted otherwise.

Q. Where sprinklers are required under oval or round duct, the centerline of the sprinkler shall be under the centerline of the duct.

R. Where sprinklers are required under rectangular duct, the centerline of the sprinkler shall be minimum 6" under duct.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Ensure required tamper and flow devices are installed and connected as required to fire alarm system including but not limited to floor control valves, dry pipe valves, elevator shaft isolation valves, post indicator valves (PIV), backflow device valves, and fire and jockey pump valves.

3.3 SCHEDULES

A. System Hazard Areas:
   1. Offices: Light Hazard.
   2. Mechanical/ Electrical, closets, Storage Rooms, Work Rooms: Ordinary Hazard, Group 1.
   3. Classrooms, Corridors, Lobbies, Vestibules, Gyms: Light Hazard.
   4. Automotive and Welding Laboratory Area: Ordinary Hazard, Group 2.
   5. Computer Laboratories: Light Hazard.

END OF SECTION

SECTION 21 3000

FIRE PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire pump, electric motor drive, controller, and accessories.

B. Electric jockey pump.

1.2 RELATED REQUIREMENTS

A. Section 21 0510 - General Fire Suppression Requirements.

B. Section 21 1100 - Fire Suppression Piping.

C. Section 21 1300 - Fire Suppression Sprinkler Systems.

1.3 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2006.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2003.

C. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2002.

D. NFPA 20 - Standard for Installation of Stationary Pumps for Fire Protection; National Fire Protection Association; 2003.

E. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

F. UL 448 - Centrifugal Stationary Pumps for Fire-Protection Service; Underwriters Laboratories Inc.; 2007.

G. UL 778 - Standard for Motor-Operated Water Pumps; Underwriters Laboratories Inc.; 2002.

H. UL 1478 - Fire Pump Relief Valves; Underwriters Laboratories Inc.; 2004.

1.4 SUBMITTALS

A. See Section 21 0510 - General Fire Suppression Requirements for submittal procedures.

B. Product Data: Provide manufacturers literature including general assembly, pump curves showing performance characteristics with pump and system, operating point indicated, NPSH curve, controls, wiring diagrams, and service connections.

C. Shop Drawings: Indicate layout, general assembly, components, dimensions, weights, clearances, and methods of assembly.

D. Shop Drawings: A complete set of building erection drawings showing a step-by-step construction sequence for the erection of the building. The erection drawings shall be prepared specifically far the building covered by these specifications showing the location of all roof and wall accessories and the exact anchor bolt locations required for each accessory.

E. Test Reports: Indicate results of hydrostatic test and field acceptance tests.

F. Manufacturer's Instructions: Indicate support details, connection requirements, for fire pump system.

G. Project Record Documents: Record actual locations of components and accessories.

H. Certificates: Certify that fire pumps meet or exceed specified requirements at specified operating conditions and that the installation complies with regulatory requirements. Submit summary and results of shop tests performed in accordance with NFPA 20.

I. Operation Data: Include manufacturers instructions, start-up data, trouble-shooting check lists, for pumps, drivers, and controllers.

J. Maintenance Data: Include manufacturers literature, cleaning procedures, replacement parts lists, and repair data for pumps, drivers and controllers.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 20 and NFPA 13; where requirements differ comply with the most stringent.

B. Perform Work in accordance with NFPA 20.

C. Equipment and Components: Bearing UL label or marking.

D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

E. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

F. Manufacturer's Factory Tests: Each individual pump shall be hydrostatically tested and run tested prior to shipment. The pump shall be hydrostatically tested at a pressure of not less than one and one-half times the no flow (shut off) head of the pumps maximum diameter impeller plus the maximum allowable suction head but in case less than 250 psig.

G. Provide certificate of compliance from authority have jurisdiction indicating approval of field acceptance tests.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire pumps and components in factory packing. Comply with manufacturer's rigging and installation instructions.

B. Protect fire pumps and components from physical damage including effects of weather, water, and construction debris.

C. Provide temporary inlet and outlet caps, and maintain in place until installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Pumps: Sterling/ Peerless; Patterson; Aurora; Fairbanks Morse; Allis Chalmers. Controllers: Cutlet-Hammer, Firetrol, Master Fire Pump Controllers.

2.2 FIRE PUMPS

A. Fire Pumps: Horizontal base-mounted type; UL 448 and UL 778; horizontal shaft, single stage, double suction, direct connected, horizontally split casing, for 250 psi maximum working pressure.
   1. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.
   2. Impeller: Bronze double suction fully enclosed, balanced and keyed to shaft.
   3. Bearings: Grease lubricated ball bearings, replaceable without opening casing.
   4. Shaft: Alloy steel with replaceable bronze shaft sleeve.
   5. Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 230 degrees F maximum continuous operating temperature.
   6. Drive: Flexible coupling with coupling guard.
   7. Baseplate: Cast iron or fabricated steel with integral drain rim.

8. Performance:
   a. Flow: 750 gpm, at 92 feet head (40psi).
   b. Motor: 25 hp, 480 volt, three phase, 60 Hz.

B. Fire Pump Accessories:
1. Eccentric suction reducer and OS&Y gate valve on suction side of pump.
2. Concentric increaser and check valve in pump discharge and OS&Y gate valve on system side of check valve.
3. Fire pump bypass fitted with OS&Y gate valves and check valve.
4. Main relief valve,if required, UL 1478, and enclosed type waste cone. Pipe to outside.
5. Suction pressure gage, 4-1/2 inch diameter dial with snubber, valve cock and lever handle.
6. Discharge pressure gage mounted on board attached to pump, with snubber, valve cock and lever handle.
7. 3/4 inch casing relief valve.
8. Float operated 3/4 inch automatic air release valve.
9. Test valve manifold with 2-1/2 inch hose gate valves with caps and chains. Locate valves inside building.
10. Flow metering system for closed loop testing.

2.3 ELECTRIC MOTOR DRIVE

A. Motor: Squirrel cage induction type, NEMA MG 1; in open drip proof NEMA 250 enclosure, 1750 rpm. Refer to Section 22 0513.

B. Controller: Reduced voltage type with auto-transformer wye-delta closed transition starter, in NEMA 2 enclosure, including the following:
1. Disconnect Switch: Externally operable, quick break type.
2. Circuit Breaker: Comply with NFPA 20; minimum 65,000 amperes interrupting capacity.
   a. The controller shall be capable of interrupting a short circuit current at least equal to the available short circuit current in the controller supply circuit.
3. Motor Starter: Energized automatically through pressure switch or manually by externally operable handle.
4. Pressure Switch: Set to cut in at manufacturers recommended psi.
5. Pilot Lamp: Indicates circuit breaker closed and power available.
6. Test Accessories: Ammeter test link and voltmeter test studs.
7. Alarm Relay: Energizes alarm to indicate circuit breaker open or power failure.
8. Switch Relay: For remote start.

2.4 PRESSURE BOOSTER (JOCKEY) PUMP

A. Manufacturers:
1. Sterling/ Peerless
2. Patterson
3. Allis Chalmers
4. Aurora
5. Fairbanks Morse
6. Grundfos

B. Capacity: 10 GPM at 40 PSI TDH with 2 HP motor for 3500 RPM.

C. Electrically operated, horizontal turbine type with standard open drip-proof horizontal motor.

D. Control by automatic jockey pump controller with full voltage starter and minimum run timer to start pump on pressure drop in system and stay in operation for minimum period of time. Fire pump shall start automatically on further pressure drop or on jockey pump failure.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 20.

B. Provide access space around pumps for service; no less than minimum as recommended by manufacturer.

C. Install piping in accordance with Section 21 1100. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For base mounted pumps, provide supports under elbows on pump suction and discharge.

D. Provide drains for bases and seals, piped to and discharging to floor drain.

E. Mount unit on vibration isolators.

F. Provide for connection to electrical service. Refer to Section 26 2717.

G. Lubricate pumps before start-up.

H. Check, align, and certify pumps by qualified installer prior to start-up.

3.2 FIELD QUALITY CONTROL

A. Perform field acceptance tests as specified in NFPA 20.

B. Perform field acceptance tests in the presence of authority having jurisdiction.

3.3 CLOSEOUT ACTIVITIES

A. Demonstrate automatic operation of system including verification of pressure switch set points.

END OF SECTION

SECTION 22 0510

GENERAL PLUMBING REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Definitions

B. Submittal Procedures Supplementing Section 01 3000.

C. Operating and Maintenance Manuals

D. Execution Requirements common to Division 22 systems

E. Pipe Sleeves within building

F. Pipe Sleeves in footings and foundations

G. Piping Pressure Tests.

H. Equipment bases and housekeeping pads

I. Training Requirements

J. Cleaning Requirements.

K. Finishing Requirements

1.2 RELATED SECTIONS

A. Section 01 2300 - Alternates.

B. Section 01 3000 - Administrative Requirements, for submittal procedures.

C. Section 01 7800 - Closeout Submittals, for additional warranty requirements.

D. Section 07 9200 - Joint Sealants

E. Section 09 9100 - Painting.

1.3 ALTERNATIVES

A. Refer to Section 01 2300 - Alternatives, for product alternatives affecting this Division.

1.4 DEFINITIONS

A. Manufacturers Representatives: Wherever MANUFACTURER'S REPRESENTATIVE is referred to in this division, said representative shall be regularly employed by the manufacturer to perform similar activities to those called for herein, which indicates his competence in that field of work.

B. Concealed: Where the word concealed is used in this Division, it shall mean items above ceilings, in attics, in crawl spaces, in chases, in tunnels, in cabinet work, and under counters or equipment so as to be not visible from an elevation of 5 feet at a horizontal distance of 10 feet.

C. Finished Spaces or Areas: Where finished spaces or areas are referred to in this Division, it shall mean all spaces except concealed spaces, mechanical rooms, or boiler rooms unless otherwise noted.

D. Provide: Furnish and install.

E. Control and Interlock Wiring: All wiring, both line voltage and low voltage, other than power wiring from an electrical distribution panel, through the primary control device, to the item of equipment.

F. Primary Control Device: That ONE device for any item of equipment which interrupts power flow during normal operation. Where magnetic starters are provided, they are the primary control. For items not switches by starters, the primary control device will be that ONE thermostat, time clock, manual switch, aquastat, P.E. switch, or relay performing the primary switching.

G. Diagrammatic: A drawing that shows arrangement and relations (as of parts).i.e: A diagrammatic drawing uses symbols rather than pictorial representation of pipes and other items shown and is not necessarily to scale. Arrangement, location, and sizes shown are firm.

H. Readily Accessible: Equipment, valves and other items requiring service shall be installed to be readily accessible. These items shall be available for maintenance or use in a space, through an access door from floor elevation, or above a lay-in ceiling by maintenance staff standing on a ladder no taller than the ceiling.

I. Noted, Indicated or Shown: Where the terms "Noted", "Indicated" or "Shown" are used in these specifications, the words "in the specifications or on the plans" shall be inferred.

J. Detail: Where reference is made to a Detail, the Detail shall be on the plans unless otherwise noted.

K. Specifications: Where reference is made to these specifications, it shall be inferred in this Division of specifications.

L. Notification by the Contractor, and Instructions to the Contractor: Where reference is made in these specifications to notification by or instructions given to the Contractor, it shall be inferred that the Architect shall be the instructor or shall be notified, as the case exists.

M. Division or Section Reference: Where reference is made to another Division or Section within this Division, refer to specifications table of contents for Division, Section, or Page Number.

N. Flow Diagram: A single-line, two-dimension, non-scaled drawing depicting arrangement and sequence of equipment, valves, controls, thermometers, gauges, and other specialty devices in a pipe system.

1.5 REGULATORY REQUIREMENTS

A. Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.

B. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.

C. Jurisdiction: Where codes or guides refer jurisdiction to local governing code officials, such official in this procedure shall be the State Fire Marshal.

D. Permits: Obtain all permits, paying all fees in connection therewith. At completion, have work inspected by proper authorities and furnish the Architect for the Owner an inspection certificate showing approval of installation.

E. Plumbing: Conform to the Georgia State Minimum Standard Plumbing Code (International Plumbing Code), 2006 Edition, with 2007, 2008, 2009, & 2010 Georgia State Amendments.

F. Fire Prevention Precautions in Cutting and Welding Areas: Conform to Article 2605 Fire Prevention Precautions, Georgia State Minimum Standard Fire Prevention Code (International Fire Code), 2006 Edition, with 2007 Georgia State Amendments, for all work involving cutting and welding.

G. Energy: Conform to the Georgia State Energy Code for Buildings (International Energy Conservation Code), 2006 Edition, with 2008 & 2009 Georgia State Amendments.

H. Electrical: Refer to Division 26. Conform to the National Electrical Code, NFPA 70, 2008 with 2009 Georgia State Amendments.

I. Building Code: Conform to the Georgia State Minimum Standard Building Code (International Building Code), 2006 Edition with 2007, 2009, and 2010 Georgia State Amendments.

1.6 PERFORMANCE REQUIREMENTS

A. Requirements specified herein are minimum. All equipment, when installed, shall perform equal to or exceed specified requirements.

1.7 VALUE ENGINEERING

A. Where the Contractor is requested to offer or make Value Engineering suggestions as a means of reducing the Project Cost, the Contractor shall present suggestion in the format prescribed herein.

B. Provide each suggestion in writing referencing the specific element involved, ie. specification article and/or drawing/detail number(s).

C. State how the proposed change impacts the project, ie. change in life expectancy, increased operating costs, etc. in addition to the reduction of first cost (Amount of cost reduction.).

D. State how the change will impact the Construction Schedule.

E. Where the change impacts the contract drawing(s), provide a sketch of the proposed change to assist in the evaluation process. If the suggestion is approved, the Contractor shall provide a drawing, as a part of the shop drawing process, showing the Contractor's proposed changes.

F. Each suggestion shall include specific language commenting that the proposed change has been or has not been successfully made previously one or more similar projects.

1.8 SUBMITTALS

A. Supplementing Division 1 requirements; the Contractor shall:
   1. Review the submittal data and check to ensure compliance with specifications prior to submitting.
      a. The Contractor agrees that submittals of equipment and material and shop drawings of equipment and material layouts required under provisions of these specifications and processed by the Architect are not Change Orders. The purpose of submittals is to demonstrate that the Contractor understands the design concept of the project by indicating the equipment and materials he intends to furnish and install, and by detailing the installation he intends to achieve.
      b. Any submittal or shop drawing not conforming to the Contract Documents without this identification and notification shall be assumed to be marked "Revise and Resubmit" (acknowledges this by the submission), and the Contractor shall promptly resubmit said submittal so as to be in full compliance with the Contract Documents.
      c. Failure of the Contractor to provide this information during the shop drawing phase shall make the Contractor responsible for all changes to achieve compliance with the Contract Documents without additional compensation.
   2. Assemble the submittal data in compete sets in hard back three-ring binders, separate binders, and bound with numbered index sheets and tabs. All submittal data shall be submitted at one time unless unavailable data would delay project progress. Data shall include capacities, complete installation instructions, dimensional data and electrical data, BHP, motor HP, operating weights and load distribution at mounting points. Any submittals sent in pieces or not secured in a three ring binder will be marked not reviewed and will be returned to the contractor.
   3. Identify all submittals by a cover sheet showing project name, specification sections, drawing or detail number, room number, date, revision date, contractor and subcontractor's organization and project manager with phone number, the model, style and size of item being submitted with manufacturers' representative, salesman (or a preparer who can

answer questions), and Preparer's phone number.

4. Manufacturers' standard drawings shall be modified by deletions or additions to show only items applicable to this project.
5. Prepare a master list of submittal proposed to be submitted on the project. This list shall be updated for each submission and shall be the first sheet(s) of the submission in the quantity that is submitted for review. The information and general format shall contain an Tab number, Item Description, Item Status and any comment.
6. Provide a Letter stating that all submittals have been checked for compliance with specifications.

B. Product Data:
1. Provide data specific to the Product proposed indicating capacity data, all standard and optional features to be supplied and all accessories and options available for that product.
2. Manufacturer's standard drawings shall be modified by deletions or additions to show only items applicable to this project.

C. Warranty: Submit the Contractor's warranty letter addressed to the Owner stating the correct project name and number, if applicable, the warranty period and ensure that form has the correct date of the Final Observation.

1.9 OPERATING AND MAINTENANCE MANUALS

A. Three (3) bound and indexed Operating and Maintenance Manuals shall be prepared by the Contractor for all equipment and be submitted for approval a minimum of two months prior to the Final Inspection. Two (2) approved copies shall be delivered to the operating personnel 30 days prior to operating instructions.

B. Each Manual shall be compiled as follows:
1. Data shall be bound in smooth surface hard back commercial quality three-ring notebooks with project identification shown on the front cover and binding back. Identification labels shall be typed and adhered with waterproof glue.
2. Notebooks shall have 9-1/2-inch by 11-1/2-inch covers with back width to permit the covers to lie parallel or to converge, and have not less than 1-1/2-inch back width.
3. Index divider sheets of heavy Manila paper shall be inserted between each section of the Manual with a 2-inch x 1/3-inch ready-cut shield tab attached to each sheet for identification of sections.
4. Data sheets and diagrams shall be 8-1/2-inch x 11-inch or be mounted on 8-1/2-inch x 11-inch sheets of 16-pound paper if smaller, with reinforced 11-inch mechanically perforated edges. Drawings and diagrams larger than 8-1/2-inch by 11-inch shall be folded up from the bottom to form a height of 11-inches and folded to the left to form a width of 8-1/2-inches.
5. Table of Contents(Index) sheets shall be provided in the order listed with identifications typed in capital letters.

C. Each Manual shall contain the following information, data and drawings:
1. Copies of all submittals(with Engineer's review comments and stamp), including all equipment and materials.
2. Manufacturer's installation, operating and maintenance instructions for each item of equipment with moving parts including recommended frequency of inspections and maintenance for one years period of time.
3. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.
4. Copies of as-built shop drawings showing layouts and construction details.

1.10 QUALITY ASSURANCE

A. Installer Qualifications:

1. Wherever the word "company" or "firm" is used in these subparagraphs, it shall mean the contractor/subcontractor of record for the installations used for proficiency qualification.
2. Refer to the individual sections within this division for additional installer qualification requirements.
3. Plumbing:
   a. The Contractor expressly warrants that the company performing the installation of the plumbing systems has demonstrated proficiency in the installation and adjustment of such systems by the successful performance of work of the nature specified herein on at least three commercial or institutional buildings, each containing minimum of 50 plumbing fixtures.
   b. The Contractor also warrants that the aforesaid installer, if any, has been in business performing services of the nature specified herein for at least three(3) years.

1.11 PRODUCT DELIVERY, STORAGE, AND PROTECTION

A. Accept all products on site in factory-fabricated protective containers. Inspect for damage.

B. Store products in a clean dry place and protect from weather and construction traffic.

C. Handle products carefully to avoid damage to components, enclosures, and finish.

D. After placement, protect products from damage during construction, by all trade contractors.

E. Protect equipment nameplates and labels from damage, being painted, scaring, etc.

1.12 WARRANTY

A. Refer to Section 01 7700- Closeout Procedures, for additional warranty requirements.

B. Where extended warranties beyond the Contractor's one (1) year warranty are specified, the additional warranty time shall start at the end of the Contractor's warranty.

C. Correct defective Work for a one year period after Date of Substantial Completion.

PART 2 PRODUCTS-NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Refer to the specifications and Architectural and Structural drawings for additional requirements pertaining to work under this discipline. Notify the Architect for clarification in the event of conflict.

B. All materials of systems installation exposed in hollow spaces that are used as ducts or plenums shall have a flame spread rating of 25 or less and a smoke development rating of 50 or less.

3.2 PREPARATION

A. Drawings are diagrammatic and show the general proximity of the equipment and pipes. They are not to be scaled, and do not include all required changes in direction or offsets necessary in coordinating the installation of various materials either between trades or within the same trade. All dimensions shall be verified at the building site. Prefabrication and/or installation of work from drawings shall be at the Contractor's risk. Refer to Architectural plans for exact building dimensions and details.

B. Space Conditions:
   1. All apparatus shall fit into the available spaces in the building and must be introduced into the building so as not to cause damage to the structure. Equipment larger than access to equipment spaces shall be disassembled into sub-assemblies for installation.

2. Where deviations from the plans are required in order to conform to the space limitations, such changes shall be made at no additional cost to the Owner and shall be subject to approval.
3. All equipment requiring service shall be made accessible. Coordinate piping installation to avoid conflict with other trades.

C. Where new work is specified tying into old work and materials are different from existing, the contractor shall request a clarification from the Architect prior to performing the work.

D. The demolition plan has been prepared to assist the contractor in determining the scope of demolition work and should not be construed to be all of the demolition required. The contractor shall visit job site (after carefully reviewing the contract documents) and determine exact areas and quantities of existing materials to be removed to accomplish new construction.

3.3 INSTALLATION

A. Clearance above and in front of electrical switchgear, electrical power panels or control panels shall be maintained by mechanical systems so that no pipes, vents, or equipment is routed above or across the space directly above this equipment in conformance with the National Electrical Code.

B. All equipment shall be installed in accordance with manufacturers' published installation instructions shipped with the equipment. In the event there is a discrepancy between these specifications or Drawings and the manufacturers' instructions, no work shall be performed until additional instructions are received.

C. Install and connect all appliances, equipment, and appurtenances as specified, indicated or required in accordance with the manufacturer's instructions and recommendations. Furnish and install complete auxiliary piping, water seals, valves, electric connections, and similar items, recommended by the manufacturer or as required for proper operation.

D. Provide equipment coupling guards shielding the perimeter and face of all new shafts and couplings. Provide openings opposite drive shafts to permit use of revolution counter.

E. Route piping to avoid skylights, translucent, and transparent ceilings.

F. Pipe Sleeves in Slabs, Masonry Walls and Partitions:
1. Provide sleeves in all slabs and walls/partitions unless otherwise noted.
2. Omit sleeves on cast iron pipe through slabs on grade.
3. Provide sleeve seals where pipe passes thru building wall to a below grade location.
4. Elevated Slabs: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a slab.
5. Masonry Partitions: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated masonry wall/partition.
6. Omit sleeves in openings core drilled in masonry partitions.
7. Rated Drywall Partitions: Twenty gage galvanized steel. Sleeves shall be sized to include the insulation with minimum gap around the insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated drywall wall/partition.
8. Non-Rated Drywall Partitions: Omit sleeves.

G. Pipe sleeves in footings and foundation walls:
1. Schedule 40 black steel pipe.

2. Water pipe, distribution piping, soil or waste pipe or building drain passing under a footing or through a foundation wall shall be installed in a pipe sleeve, two pipe sizes larger than the pipe passing through.
3. Sleeves in walls to spaces below grade shall be provided with 10 gauge leak plates.

H. Seal sleeves and openings in mechanical room walls, fire rated partitions, and floors above grade vaportight, watertight, or for smoke/fire protection as applicable. Refer to Section 07 2700-Firestopping.

I. Seal sleeves and openings in exterior walls vaportight, or watertight as applicable. Refer to Section 07 9200, Sealants and caulking.

J. Equipment and pipe support upper attachments shall be 3" x 3" x 1/4" galvanized steel angles, minimum, spanning structural members unless noted otherwise. Provide inserts and bolts for supporting pipes and equipment from structural members.

K. Saw cut or core drill openings in existing work for the installation of the mechanical system. Patching shall be performed by the trade whose work is cut. Contractor shall lay out and install his work ahead of the work of other trades wherever possible.

3.4 PIPING PRESSURE TESTS

A. General:
1. Provide 48 hours notification to the Architect in advance of any test.
2. Complete tests prior to insulating. Leaks shall be repaired, defective materials replaced, and system shall be retested. Strike all joints in copper and steel piping under a pressure test. Conduct tests prior to connecting to equipment or isolate equipment from system.
3. No water pressure test shall be conducted in freezing weather where subject to freezing.
4. Test shall be maintained at conditions specified until approved but, in no event, for less than eight (8) hours minimum duration, unless otherwise noted.
5. Hydrostatic pressure tests shall maintain pressure without change, except that due to temperature change.

B. Domestic Water System: Hydrostatic test; 150 PSIG.

C. Soil, Waste and Vent System: Static test; 10 feet minimum head. Test system in its entirety or in sections. Plug all openings except highest opening above the roof. Water shall be kept in the the system, or in the portion under test, for a minimum of one (1) hour. Inspect the system, or the portion under test, after one (1) hour, the system shall be tight at all points.

D. Storm Drain System: Static test; 10 feet minimum head. Test system in its entirety or in sections. Plug all openings except highest opening above the roof. Water shall be kept in the the system, or in the portion under test, for a minimum of one (1) hour. Inspect the system, or the portion under test, after one (1) hour, the system shall be tight at all points.

E. Multistory Buildings: Test tees shall be provided in soil, waste and storm drain piping to eliminate pressure testing of more than two floors at a time.

F. Natural Gas System: Pressure test; 50 PSIG air or inert gas; 3 hours minimum duration. Oxygen shall not be used.

G. Force Main Piping: Hydrostatic Test; 100 PSIG.

H. Compressed Air System Above & Below Ground: To Pressure Reducing Stations: Pressure test; 150 PSIG air or inert gas; three hours minimum duration. Oxygen shall not be used.

3.5 EQUIPMENT BASES and HOUSEKEEPING PADS

A. Provide housekeeping and equipment bases as shown or listed below. Rough up slab under bases before pouring concrete.

B. Materials: Refer to Section 03 3000 - Cast-in-Place Concrete. Omit test cylinders for concrete poured under this section.

C. Bases/Pads shall be rectangular with vertical sides 4-inches from centerline of anchor bolts or 2 inches from edges of equipment supports, whichever provides the larger dimension, side of equipment or base edge, unless otherwise noted.

D. Height:
1. Booster Pump on Grade: 4-inch concrete base.
2. Vacuum Pump, Air Compressor, Pumps Above Grade: Factory fabricated inertia base.
3. Water Heater: 4-inches.
4. Concrete curb at all pipe penetrations of floors in mechanical rooms above grade: 4-inches or as shown on plans.
5. Housekeeping Pads for Other Equipment: 4-inches or as shown on plans.

E. Chamfer: 3/4-inch on edges and corners.

F. Reinforcing: 6"x 6" 10/10 WWF at mid-depth of slab. (4 inch thick pads.)

3.6 STARTING EQUIPMENT AND SYSTEMS

A. Adjust equipment for proper operation within manufacturers' published tolerances.

B. Demonstrate proper operation of systems and equipment to the Owner 's designated representative.

3.7 DEMONSTRATION, TRAINING AND INSTRUCTIONS

A. Instruct operating personnel designated by the Using Agency in operation and maintenance of system prior to request for final inspection. Provide signed statement certifying instructions have been received.

B. A manufacturer's service representative shall provide the instructions for each piece of equipment on system when specified in other Sections of this Division. A manufacturer's sales representative is not acceptable. (The instructor shall not be a sales person, but shall have service experience on a continuing basis and be knowledgeable about the subject equipment.)

C. The Contractor shall give notice to the Architect not less than 60 days of the anticipated date of instruction to allow planning by the Using Agency.

D. The Contractor shall request the instruction date not less than 15 days of the desired date for coordination with the Using Agency. Operating manuals for the equipment/systems on which instructions are being given shall be in the possession of the operating personnel not less than 30 days prior to the date of instruction.

E. The contractor shall give an orientation session to operating personnel for achieving familiarity (not instructions) of the systems approximately 5 days prior to the instruction date. The Contractor's representative giving instruction shall be knowledgeable in the equipment/systems to allow quality recordings by the Using Agency.

F. The Contractor shall develop not less than three (3) copies of the instructions with an index for easy retrieval of information.

3.8 CLEANING and PROTECTION

A. All materials, equipment and mechanical rooms shall be cleaned prior to Final Observation.

B. Wash down and scrub clean all mechanical room floors, walls, equipment bases and equipment.

C. Paint equipment where finish has been damaged requiring retouching of finish to match factory finish.

D. Chipped or scraped paint shall be retouched to match original finish.

E. Clean and polish all equipment nameplates. All nameplate information shall be legible.

F. All dents and sags in equipment casings shall be straightened.

G. All insulation, equipment, pipe, pipe fittings and appurtenances shall be free of dust, rust and stains prior to Final Observation.

3.9 FINISHING PLUMBING EQUIPMENT AND MATERIAL

A. Use paint systems specified in Division 9 for the substrates to be finished.

B. Paint shop-primed equipment.

C. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

D. Paint all insulated and exposed pipes, unless otherwise indicated.

E. All ferrous fasteners and hanger supports not having a corrosion resistant plated finish shall be painted to prevent rust.

F. Paint all equipment, including that which is factory-finished, exposed to weather or to view on the roof and outdoors.

G. Paint all exposed un-insulated ferrous metals.

END OF SECTION

SECTION 22 0513

MOTORS FOR PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single phase electric motors

B. Three phase electric motors

1.2 RELATED REQUIREMENTS

A. Section 22 0510 - General Plumbing Requirements

1.3 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 1990 (Reapproved 2000).

B. International Energy Code, 2000 Edition.

C. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; Institute of Electrical and Electronic Engineers; 2004.

D. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2006.

E. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.4 SUBMITTALS

A. See Section 22 0510 - General Plumbing Requirements, for submittal procedures.

B. Product Data:
   1. Provide wiring diagrams with electrical characteristics and connection requirements.
   2. Provide product data including motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, motor type, enclosure type, insulation class, NEMA design designation, service factor, power factor at full load, nominal efficiency at full load and weight.

C. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.5 QUALITY ASSURANCE

A. Conform to NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Century, Lincoln, Marathon, Magnetec, Toshiba.

2.2 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:
   1. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz.
   2. Motors 1/2 HP and larger: three phase 60 Hz.
      a. 460 volt motors on 480 volt systems.
   3. Refer to Electrical drawings for voltage and phase required.

B. Efficiency: Motors 1 HP and larger shall be premium efficiency motors and have minimum full load efficiencies not less than listed in the Energy Code.

C. Brake Horsepower: All motors shall have rated horsepower at least 10 percent above the indicated brake horsepower of equipment including belt losses and inlet vane losses.

D. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 40 degrees C environment.
   3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
   4. All copper windings and leads.
   5. Motors for belt driven equipment, base mounted pumps, and direct drive fans shall have cast iron yoke and bearing housings.

E. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

F. Motors serviced by Variable Frequency Controllers: Motors shall be Definite Purpose Inverter-Fed Motors complying with NEMA MG1-Part 31. Stator laminations shall be vacuum-pressure impregnated with varnish for reduction of audible motor noise. Motors shall be equipped with a kit to electrically ground the motor shaft to prevent eddy current damage to bearings.

G. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.3 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not conform to these specifications.

B. Single phase motors for shaft mounted fans: Split phase type.

C. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.

D. Single phase motors for hard starting applications including outdoor applications for fans, blowers, and pumps: Capacitor start, capacitor run type.

E. Motors located in exterior locations and air cooled condensers: Totally enclosed type.

2.4 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.5 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Minimum Service Factor: 1.35.

E. Overload Protection: Single phase motors shall be furnished with built-in automatic reset overload protection.

F. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings.

2.6 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Minimum Service Factor: 1.35.

F. Overload Protection: Single phase motors shall be furnished with built-in automatic reset overload protection.

G. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

H. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

I. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.7 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Minimum Service Factor: 1.15.

G. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

H. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 1.

K. Nominal Efficiency: As specified at full load and rated voltage when tested in accordance with IEEE 112.

L. Nominal Power Factor: As specified at full load and rated voltage when tested in accordance with IEEE 112.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION

SECTION 22 0519

METERS AND GAGES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pressure gages and pressure gage tappings.

B. Thermometers and thermometer supports.

C. Test plugs.

1.2 RELATED REQUIREMENTS

A. Section 22 0510 - General Plumbing Requirements.

B. Section 22 1005 - Plumbing Piping.

1.3 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers; 2005.

B. ASTM E 1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2007.

C. ASTM E 77 - Standard Test Method for Inspection and Verification of Thermometers; 2007.

1.4 SUBMITTALS

A. Refer to Section - 22 0510 General Plumbing Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.5 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.1 PRESSURE GAGES

A. Manufacturer: Trerice Model 500X.

B. Other acceptable manufacturers offering equivalent products: Duro 102, Marsh 103, Palmer 40SPDLH, Weksler BM1, Weiss AG-1.

C. Gage: ASME B40.1, UL 393 case, bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background and pulsation snubber.
   1. Size: 4-1/2 inch diameter.
   2. Case: Cast aluminum with phosphor bronze bourdon tube, Stem(flangeless) mounting.
   3. Mid-Scale Accuracy: One percent.

2.2 PRESSURE GAGE TAPPINGS

A. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi, handwheel, threaded as manufactured by Crane, Model 88, Hammond IB415, Milwaukee 600, Stockham B64.

B. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections, as manufactured by Trerice, Model 872,Duro, Marsh, Weksler, Weiss.

2.3 STEM TYPE THERMOMETERS

A. Manufacturer: Trerice Model AX9.

B. Other acceptable manufacturers offering equivalent products: Ashcroft 200-36E, Duro 7EZ3-6, Moeller 706AW, Palmer 9FLA, Weiss 7VS6, Weksler AA5.

C. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E 1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 7 inch scale.
   2. Window: Clear Lexan.
   3. Stem: 3/4 inch NPT brass.
   4. Accuracy: 2 percent, per ASTM E 77.
   5. Calibration: Degrees F.

2.4 THERMOMETER SUPPORTS

A. Socket: Brass or stainless steel separable sockets for thermometer stems. Provide cap and chain where not used to mount permanent instrument or control sensor. Provide lagging extension when mounted on insulated pipe.

2.5 TEST PLUGS

A. Manufacturer: FDI Model Super Seal.

B. Other acceptable manufacturers offering equivalent products: MG Piping Products Co., Sisco, Trerice, Texas Fairfax, Universal Lancaster.

C. Test Plug: 1/4 inch or 1/2 inch brass fitting and retained cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F. Provide extra long shaft when mounted on insulated pipe.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide one pressure gage per base mounted pump, installing taps before strainer (Suction Diffuser) and on suction and discharge of pump. Pipe to gage.

C. Install pressure tappings on piping where specified or shown on flow diagrams and details. Provide needle valve to isolate each tapping connection to system. Extend nipples to allow clearance from insulation.

D. Install sockets for all thermometers and control sensors. Provide spare sockets with cap and chain as shown on flow diagrams and details.

E. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets.

F. Mount sockets in 3/4 inch NPT pipe openings. Use lateral-o-let on vertical pipe.

G. Provide instruments with scale ranges selected according to service with largest appropriate scale.

H. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical. Fill sockets with SAE 10W oil for conduction.

I. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

J. Locate test plugs adjacent to thermometers, temperature wells, pressure gages, coil connections, and where shown on flow diagrams. Install in 1/2 inch pipe opening(minimum), with bushing.

K. Install test plugs vertical to horizontal. Do not install pointing down.

3.2 SCHEDULES

A. Pressure Gages, Location and Scale Range:
   1. Pumps, 0 to 150 psi.
   2. Pressure reducing valves, 0 to 150 psi.

B. Stem Pipe Type Thermometers Scale Range:
   1. Provide thermometers where shown on flow diagrams and details.
   2. Domestic hot water supply and recirculation, 30 to 180 degrees F.

END OF SECTION

SECTION 22 0553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates

B. Pipe Markers

C. Valve Tags

1.2 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.3 SUBMITTALS

A. Refer to Section 22 0510 - General Plumbing Requirements, for submittal procedures.

B. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

B. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

C. Size:1/2 inch high letters unless otherwise noted.

D. Size when located on ceiling grid: 3/8 inch high letters unless otherwise noted.

2.2 PIPE MARKERS

A. Manufacturers: Brimar, Seton Name Plate Co Setmark, Kolbi Industries Style A thru E(5 inch and smaller) else Style F thru H, Marking Services.

B. Comply with ASME A13.1.

C. Pipe Markers for Indoor Use: Seton Setmark; media indicator with direction-of-flow arrows on calendered vinyl sheet; snap-around type for pipe sizes to 5-7/8 inches diameter, strap around type with nylon ties for pipe sizes 6 inches diameter and larger.

2.3 VALVE TAGS

A. Manufacturers: Brimar, Kolbi, Seton.

B. Brass; Media and identification number imprinted on tag.

C. Securing Devices: Number 6 brass bead chain; provide one securing device for each tag in accepted schedule.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Identify equipment such as pumps, heat transfer equipment, tanks, enclosed motor controllers and water treatment devices with plastic nameplates.

C. Where equipment is located above ceilings; Apply nameplate to ceiling grid for equipment located above accessible ceilings or to access panel for non-accessible ceilings.

D. Identify control panels and major control components outside panels with plastic nameplates.

E. Install Pipe Markers on all piping systems at the following Locations:
   1. Mechanical Equipment Rooms:
      a. Within 18 inches of each valve.
      b. Within 36 inches of each 90 elbow, tee, connection to equipment or vessel and point where pipe exits room.
      c. At not over 20 feet intervals along all exposed piping.
   2. Above Suspended Ceilings:
      a. Within 18 inches of each valve or valve assembly.
      b. At tees, identify both main and branch within 36 inches of tee.
      c. Within 36 inches of each 90 elbow.
      d. At not over 30 feet intervals along all concealed piping.
   3. Piping Exposed in Rooms Other Than Mechanical Equipment Areas:
      a. Omit identification on piping, 1 inch exterior diameter or smaller(insulated or uninsulated) or exposed at connections to equipment or plumbing fixtures.
      b. With the above exception, identify at not less than one point each piping run visible in each room, with identification on not over 20 feet intervals.

END OF SECTION

SECTION 22 0719

PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation

B. Jackets and accessories

1.2 RELATED REQUIREMENTS

A. Section 22 0510 - General Plumbing Requirements

B. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts

1.3 REFERENCE STANDARDS

A. ASTM C 195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007.

B. ASTM C 411 - Test Method for Hot-Surface Performance of High Temperature Thermal Insulation.

C. ASTM C 449/C 449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2000.

D. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.

E. ASTM C 534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2007a.

F. ASTM C 585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System); 1990 (Reapproved 2004).

G. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.

H. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

I. ASTM E 136 - Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 F.

J. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association 2007.

K. UL 910 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; 2003.

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; 2003.

1.4 SUBMITTALS

A. Refer to Section 22 0510 - General Plumbing Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. All insulation, mastics, coatings, sealants, and adhesives shall be certified by the manufacturer to be Asbestos-free.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.7 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.2 GLASS FIBER (RIGID)

A. Manufacturers:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com.
   3. Owens Corning Corp: www.owenscorning.com.
   4. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C 547 and ASTM C 795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. 'K' value: ASTM C 177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
   2. Maximum service temperature: 650 degrees F.
   3. Maximum moisture absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: Factory applied white kraft paper with glass fiber yarn, bonded to aluminized film with self sealing lap and butt strips; moisture vapor transmission when tested in accordance with ASTM E 96 of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive:
   1. Compatible with insulation.

F. Insulating Cement/Mastic:
   1. ASTM C 195; hydraulic setting on mineral wool.

G. Insulating Cement:
   1. ASTM C 449/C 449M.

2.3 GLASS FIBER, FLEXIBLE

A. Manufacturers: Certainteed, Knauf, Owens-Corning, JohnsManville.

B. Insulation: ASTM C 553; flexible, noncombustible blanket.
   1. 'K' value: 0.36 at 75 degrees F, when tested in accordance with ASTM C 518.
   2. Maximum Service Temperature: 450 degrees F.
   3. Maximum Water Vapor Sorption: 5.0 percent by weight.

4. Density: 3/4 lb/cu ft.

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Tie Wire: Annealed stainless steel, 16 gage.

2.4 POLYISOCYANURATE CELLULAR PLASTIC

A. Manufacturers: Dow Chemical Trymer 2000 XP.

B. Insulation Material: ASTM C 591, rigid molded modified polyisocyanurate cellular plastic.
1. Dimension: Comply with requirements of ASTM C 585.
2. 'K' value: 0.19 at 75 degrees F, when tested in accordance with ASTM C 518.
3. Minimum Service Temperature: -70 degrees F.
4. Maximum Service Temperature: 300 degrees F.
5. Water Absorption: 2.0 percent by volume, maximum, when tested in accordance with ASTM D 2842..
6. Moisture Vapor Transmission: 4.0 perm in.
7. Connection: Waterproof vapor barrier adhesive.

2.5 FIRE BARRIER PLENUM WRAP FOR PLASTIC PIPE

A. Manufacturers: Armstrong AP, 3M, JohnsManville.

B. Insulation: Inorganic blanket encapsulated with a scrim-reinforced foil.
1. 'K' ('Ksi') value: ASTM C 177; 0.27 at 75 degrees F (0.04 at 24 degrees C).
2. Maximum moisture absorption: ASTM D 1056; 5.0 percent (pipe) by volume, 6.0 percent (sheet) by volume.
3. Water Vapor Permeability: 0.17 perm-inches, when tested in accordance with ASTM E 96.
4. Flame spread/smoke developed rating of 25/50 maximum when tested in accordance with ASTM E84 .
5. Minimum Service Temperature: -40 degrees F.
6. Maximum Service Temperature: 220 degrees F.
7. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.6 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers: Armstrong AP, Halstead, JohnsManville, Rubatex.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 3; use molded tubular material wherever possible.
1. 'K' ('Ksi') value: ASTM C 177; 0.27 at 75 degrees F (0.04 at 24 degrees C).
2. Maximum moisture absorption: ASTM D 1056; 5.0 percent (pipe) by volume, 6.0 percent (sheet) by volume.
3. Water Vapor Permeability: 0.17 perm-inches, when tested in accordance with ASTM E 96.
4. Flame spread/smoke developed rating of 25/50 maximum when tested in accordance with ASTM E84 .
5. Minimum Service Temperature: -40 degrees F.
6. Maximum Service Temperature: 220 degrees F.
7. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.7 JACKETS

A. Saran Industrial Vapor Retardant Film:
   1. Manufacturers: Dow Chemical Co.
   2. Material: Polyvinylidene chloride polymer film, 4-mil minimum thickness.
   3. Adhesive: Compatible with insulation and jacket.
   4. Vapor Retardant Tape: Compatible with film jacket by same manufacturer.

B. PVC Plastic.
   1. Manufacturers: Ceel-Co., Proto PVC, and Manville Zeston.
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E 96/E 96M.
      d. Thickness: 15 mil.
      e. Connections: Brush on welding adhesive.
   3. Covering Adhesive Mastic:
      a. Compatible with insulation.

C. ASJ (All Service Jacket): Factory applied white kraft and foil laminate, reinforced, fire retardant jacket (ASJ) with self sealing lap and butt strips. Jackets shall meet the requirements of ASTM C1136.

D. Glass Fabric Vapor Barrier Finish;
   1. Cloth: Untreated 9 oz./sq. yd. weight.
   2. Blanket: 1.0 lb/cu ft density.
   3. Weave: 5x5.
   4. Lagging Adhesive: Fire resistant compatible with insulation.
   5. Finish: Vinyl emulsion type acrylic, compatible with insulation, grey color.

2.8 STAPLES, BANDS, AND WIRES

A. Bands shall be galvanized steel, aluminum, brass, or nickel copper alloy, of 3/4 inch nominal width. The band thickness exclusive of coating shall be not less than 30 gauge for steel and nickel copper alloy.

B. Wire shall be 18-gauge stainless steel.

2.9 ADHESIVES, COATINGS, SEALING COMPOUNDS AND PROTECTIVE FINISHES

A. Lagging Adhesive and Coating for Glass Cloth Jackets and Other Facings - MIL-A-3316 B, Class 1.

B. Lap Adhesive for Vapor Barrier Jacket - MIL-A-3316 B, Class 2.

C. Bonding Adhesives - for securing insulation to metal surfaces - MIL-A-3316 B, Class 2 for temperature up to 200 degree F.

D. Contact Type Adhesive - For installing flexible unicellular insulation - MIL-A-24179, Type II, Class 1.

E. Bedding Compound and Joint Sealers - MIL-B-19564A.

F. Coating Compound - Vapor Barrier Treatment - MIL-C-19565B, Type 1 or II.

G. Protective Finish Outside of Buildings - Coating Compound MIL-C-19565 B, Type I.

H. Manufacturers: Childers, Foster, Armstrong, Mon-Eco.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations. Exterior of insulation shall be uniform in appearance.

D. Insulation jacket shall fit snug to insulation.

E. Fixture Supply Piping Exposed and in Cabinets: Do not insulate.

F. Domestic Cold Water Piping in Plumbing Chases and Concealed in Non-exterior Walls: Do not insulate.

G. Floor Drain Primer: Insulate same as Domestic Cold Water where located above grade. Where located below grade, provide 1-inch thick flexible elastomeric cellular insulation.

H. Valves and fittings:
   1. Insulate pipe and all valves and fittings including valve bonnets on domestic cold water, domestic hot water, and horizontal storm drain piping. Leave only valve stems, open ends of wells and gauge cocks exposed.
   2. All Other Piping: Insulate pipe and fittings, but omit insulation on unions and valves. Taper insulation ends and cover with jacket material.

I. Insulation at Hangers: Hangers for horizontal, chilled water, horizontal storm drain, and trapeze supports shall be outside of insulation with saddles as specified herein.

J. Saddles: Provide galvanized steel saddles at each point where pipe insulation passes through a hanger or rests on a support. Saddles shall be 180 arc for horizontal piping, 360 arch for vertical piping. Length and gauge of saddle shall be as follows:
   1. 2 inch pipe size and smaller: 18 Gauge saddle, 8 inch long, minimum.
   2. 2-1/2 & 3 inch pipe size: 18 Gauge saddle, 12 inch long, minimum.
   3. 4 inch pipe size: 16 Gauge saddle, 16 inch long, minimum.
   4. 6 inch pipe size and larger: 16 Gauge saddle, 24 inch long, minimum.

K. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

L. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

M. Flexible elastomeric cellular rubber insulation: Install without splitting and under compression during pipe fabrication. Seal Joints with adhesive. Paint exposed insulation with two coats of vinyl insulation paint after adhesive has dried for twelve hours, minimum. Allow two hours, minimum, between coats.

N. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 22 0510.

O. Fiber Glass, Flexible:
   1. Do not pull insulation tight around pipes.
   2. Lap transverse joints 2 inch, minimum and secure with staples 18 inches on center.
   3. Wrap insulation with Tie Wire 18 inches on center, maximum.

P. Pipe Exposed in Mechanical Equipment Rooms: Finish with ASJ and PVC fitting covers.

3.3 CLEANING

A. Clean adjacent surfaces, valves, valve handles, etc of jacketing materials.

3.4 SCHEDULES

A. Plumbing Systems:
   1. Domestic Water:
      a. Concealed and Exposed Above 10ft Above Finished Floor Domestic Hot, Cold and Recirculating Piping:1 inch thick rigid glass fiber with factory ASJ jacket.
      b. Exposed Below 10ft Above Finished Floor Domestic Hot, Cold and Recirculating Piping:1 inch thick rigid glass fiber with factory ASJ jacket.
   2. Concealed HVAC Condensate Waste Piping Above Grade:1 inch thick polyisocyanurate cellular plastic with Saran vapor jacket. Insulate fittings with pipe insulation mitered to fit.
   3. Exposed HVAC Condensate Waste Piping Above Grade: 1 inch thick polyisocyanurate cellular plastic with Saran vapor jacket and PVC finish jacket. Insulate fittings with pipe insulation mitered to fit.

END OF SECTION

SECTION 22 1005

PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.
   1. Sanitary sewer
   2. Force Main
   3. Domestic water
   4. Natural Gas
   5. Valves

1.2 RELATED REQUIREMENTS

A. Section 22 0510 - General Plumbing Requirements.

B. Section 22 0553 - Identification for Plumbing Piping and Equipment.

C. Section 22 0719 - Plumbing Piping Insulation.

D. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.

E. Section 22 1006 - Plumbing Specialties

F. Section 22 4000 - Plumbing Fixtures

1.3 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 1999, and addenda A&B (R2004).

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; The American Society of Mechanical Engineers; 2005.

C. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

D. ASME B16.4 - Gray Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005) (ANSI B16.18).

F. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).

G. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; The American Society of Mechanical Engineers; 2001.

H. ASME B31.1 - Power Piping; The American Society of Mechanical Engineers; 2007 (ANSI/ASME B31.1).

I. ASME B31.2 - Fuel Gas Piping; The American Society of Mechanical Engineers; 1968.

J. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2004 (ANSI/ASME B31.9).

K. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2007.

L. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2007.

M. ASTM A 74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2006.

N. ASTM A 234/A 234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2007.

O. ASTM A 888 - Hubless Cast Iron Pipe and Fittings.

P. ASTM B 32 - Standard Specification for Solder Metal; 2004.

Q. ASTM B 42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2002.

R. ASTM B 75 - Standard Specification for Seamless Copper Tube; 2002.

S. ASTM B 88 - Standard Specification for Seamless Copper Water Tube; 2003.

T. ASTM B 88M - Standard Specification for Seamless Copper Water Tube (Metric); 2005.

U. ASTM B 302 - Standard Specification for Threadless Copper Pipe, Standard Sizes; 2007.

V. ASTM B 306 - Standard Specification for Copper Drainage Tube (DWV); 2002.

W. ASTM C 564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2003a.

X. ASTM C 1540-04- Standard Specification for Heavy Duty Shielded Couplings joining Hubless Cast Iron Soil Pipe and Fittings.

Y. ASTM C 1563- Standard test method for Gaskets for use in Connection with Hub and Spigot Cast Iron Soil Pipe and Fittings for Sanitary Drain, Waste, Vent and Storm Piping Applications.

Z. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; 2005 (ANSI/AWWA C105/A21.5).

AA. AWWA C110/A21.10 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm Through 1200 mm), for Water and Other Liquids; American Water Works Association; 2003.

AB. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; 2007 (ANSI/AWWA C111/A21.11).

AC. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; 2002, and Errata 2002 (ANSI/AWWA C151/A21.51).

AD. AWWA C651 - Disinfecting Water Mains; American Water Works Association; 2005 (ANSI/AWWA C651).

AE. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; Cast Iron Soil Pipe Institute; 2005.

AF. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; Cast Iron Soil Pipe Institute; 2004.

AG. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

AH. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2006.

AI. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2005.

AJ. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2005a.

AK. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

AL. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

AM. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 1996.

AN. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2006.

1.4 SUBMITTALS

A. Refer to Section 22 0510 - General Plumbing Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.5 QUALITY ASSURANCE

A. All cast iron pipe and fittings shall be marked with the Collective Trademark of the Cast Iron Soil Pipe Institute.

B. Perform Work in accordance with State of Georgia, standards.

C. Valves: Manufacturer's name and pressure rating marked on valve body.

D. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.6 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State of Georgia plumbing code.

B. Conform to applicable code for installation of backflow prevention devices.

C. Disinfection shall be in accordance with Environmental Protection Division, Georgia Department of Natural Resources "Rules for Safe Drinking Water".

D. Domestic water piping system shall be sterilized, complying with Federal Specifications BB-C-120. Work shall be performed by licensed operator.

E. Water Sample Certification: Water samples from the sterilized domestic water piping system shall be tested and approved by the local Health Department.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A 74 service weight.
   1. Fittings: Cast iron.
   2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C 564 gaskets or lead and oakum.

2.2 SANITARY SEWER PIPING, ABOVE SLAB ON GRADE:

A. Cast Iron Pipe: CISPI 301 or ASTM A888, hubless, above floor.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310 or ASTM C1540-04, neoprene gaskets and stainless steel clamp-and-shield assemblies; Heavy Duty.
      a. Manufacturers (Number of Bands for Coupling for Pipe Sizes) 1½" thru 4": Mission 4, Tyler Wide Body 4; Husky 4; Clamp-ALL-2 and Ideal Heavy-Duty Coupling.
      b. Manufacturers (Number of Bands for coupling for Pipe Sizes) 5" thru 10": Mission 6, Tyler Wide Body 6; Husky; Clamp-ALL-4 and Ideal Heavy-Duty Coupling.

2.3 FORCE MAIN: (Elevator Sump Pump Piping)

A. Ductile Iron Pipe (below ground): ANSI A21.51, 250 PSI minimum working pressure, with mechanical joints.
   1. Fittings: Cast iron, ANSI A21.10.

B. Steel Pipe (Above Ground): ASTM A 53, Schedule 80 galvanized steel.
   1. Galvanized Cast Iron Fittings: Flanged, 250 pound, ASTM A53, class B.

2.4 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: Ductile or gray iron, standard thickness.
   2. Joints: AWWA C111/A21.11, rubber gasket with 3/4 inch diameter rods.

2.5 WATER PIPING, ABOVE SLAB ON GRADE

A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B 32, alloy Sn95 solder.

2.6 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A 53/A 53M Schedule 40 black.
   1. Fittings: ASTM A 234/A 234M, wrought steel welding type.
   2. Joints: ASME B31.1, welded.
   3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.7 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A 53/A 53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A 234/A 234M, wrought steel welding type.
   2. Joints: NFPA 54, threaded or welded to ASME B31.1.

B. Valve Connections: 2" and smaller - threaded; 2 1/2" and larger - flanged.

2.8 UNIONS, FLANGES AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:

1. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:
1. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier. Provide where connecting ferrous and non-ferrous piping.

2.9 PIPE HANGERS AND SUPPORTS

A. Manufacturers: Anvil, B-Line, Grinnell, Globe or Michigan. Figure numbers are for Michigan.

B. Plumbing Piping - Drain, Waste, and Vent:
1. Conform to ASME B31.9.
2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis. Figure 400.
3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
5. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
6. Vertical Support: Steel riser clamp.
7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

C. Plumbing Piping - Water:
1. Conform to ASME B31.9.
2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel, adjustable swivel, loop. Figure 100.
3. Hangers for Cold Pipe Sizes 2 Inches and Over: Copper electroplated carbon steel , adjustable, clevis. Figure 402.
4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Copper electroplated carbon steel, adjustable, clevis. Figure 402.
5. Multiple or Trapeze Hangers(Up to 2 inch: Green epoxy coated, cold formed, lipped steel channels, sized for pipe load and span, 1-5/8" x 1-5/8" x 12 gauge minimum, with pipe/tubing clamps, elastomer cushion, spring held, hardened steel nuts and hanger rods.
6. Vertical Support: Steel riser clamp.
7. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
8. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.10 GATE VALVES

A. Manufacturers: Domestic Hot, Tempered, and Cold Water 3" and larger.
1. Crane; Model 461.
2. Nibco, Inc; Model F619: www.nibco.com.
3. Grinnell; Model 6060A: www.milwaukeevalve.com.
4. Hammond; Model IR 1138HI.
5. Stockham; Model G612.
6. Milwaukee Valve Company; Model F2882-M: www.milwaukeevalve.com.
7. Watts; Model F-502.

B. MSS SP-70, Class 125, Iron body, bronze trim, bronze seat, non-rising stem, cast or malleable iron handwheel, solid bronze wedge disc, flanged ends, 200 WOG.

C. Up To and Including 3 Inches:
1. Manufacturers: Crane Model 1324, Grinnell 3000SJ, Hammond IB 647, Kitz 42, Milwaukee 115, Nibco S113, Stockham B104, Watts B 3001.

2. MSS SP-80, Class 125, bronze body, bronze trim, non-rising stem, cast or malleable iron handwheel, inside screw, solid wedge disc, solder ends.

2.11 GLOBE VALVES

A. Manufacturers: PRV Bypass Piping
   1. 2-inch and Smaller
      a. Up To and Including 3 Inches:
      b. Crane: 1310
      c. Grinnell: 3210SJ
      d. Hammond: IB412
      e. Kitz: 11
      f. Milwaukee: 1502
      g. Nibco: S211-Y
      h. Stockham: B20T
      i. Watts: B4001-T
      j. Victaulic: 786
   2. 125 SWP, 200 WOG, Bronze body, bronze regrinding disc, solder ends.
   3. Class 125: www.griswoldcontrols.com.

2.12 BALL VALVES

A. Up To and Including 2 Inches:
   1. Two Piece Manufacturers: Apollo Model 70-100, Crane 9301, Flow Design HB/HC, Hammond 8201, Milwaukee BA200, Nibco T580, Stockham S214, Watts B6000, Kitz #68.
   2. 400 psig WOG, Bronze two piece body, standard port, chrome plated brass ball, reinforced teflon seats and stuffing box ring, blow-out proof stem design, adjustable packing gland, zinc coated steel lever handle with vinyl hand grip with memory stops on balance valves , threaded ends.

2.13 GAS VALVES

A. Cast iron body, brass plug, full port opening.

B. Manufacturers: 2" and smaller, threaded, bronze.
   1. Crane Valve; Model No. 2180.
   2. Resun; Model R-1430.
   3. McDonald; Model 10710.

C. Bronze/brass body and plug, teflon seats and seals, full port opening.

D. Construction 2-1/2 Inches and Larger: MSS SP-78, 175 psi CWP, cast iron body and plug, pressure lubricated, teflon or Buna N packing, flanged ends. Provide lever operator with set screw.

2.14 FLOW INDICATOR-BALANCERS

A. Manufacturers: B&G Circuit Setter, AAF #6000, Taco #790, Illinois #6000, Flow Set -F, Thrush Florater, Gerand, Armstrong "CBV", Wheatley "BV", Watts CSM61, Tour & Anderson 780 Series..

B. Balancer: Calibrated bronze screwed balance valve with indicating pointer, memory stop, and with pressure taps for connecting differential pressure meter. Pressure taps shall be equipped with caps and integral check valves. Each valve shall have preformed, removable insulation cover. Locate to provide unrestricted flow up and down-stream in accordance with manufacturer's recommendations.

C. Meter: Portable differential pressure gauge with flexible tubing, shut-off valves and case. Deliver gauge to Operating Personnel upon completion of testing and balancing. B&G RO-2, AAF PG-1, Taco Circuit Setter meter, Flow Set 300.5.

2.15 SWING CHECK VALVES

A. 2 Inches and smaller:
   1. Manufacturers: Crane Model 1340, Grinnell 3300SJ, Hammond IB 912, Kitz #23, Milwaukee 1509, Nibco S413, Stockham B-309, Watts B-5001.
   2. MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder ends.

B. 2 1/2 Inches and larger:
   1. Crane Model 373, Hammond IR1124HI, Milwaukee F-2974-M, Nibco F918-B, Stockham G931, Grinnell 6300A, Watts F-511.
   2. MSS SP-71, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged ends.

2.16 WATER PRESSURE REDUCING VALVES

A. Manufacturers:
   1. Watts Regulator Company; Model 223SB, www.wattsregulator.com
   2. Cash-Acme; Model 55S1
   3. Mason-Neilan; Model 227 or 414
   4. Wilkins; Model 500YSBR
   5. Conbraco/Apollo; Model 36HZ1X-01

B. Up to 2 Inches:
   1. MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends. Made in the USA with corrosion resistant materials. Valve shall be made in the USA with corrosion resistant components and materials.

C. Over 2 Inches:
   1. MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.17 RELIEF VALVES

A. Pressure Relief:
   1. Manufacturers:
      a. Cla-Val Co: www.cla-val.com.
      b. Henry Technologies: www.henrytech.com.
      c. Watts Regulator Company: www.wattsregulator.com.
      d. Conbraco/Apollo; 10-600.
   2. AGA Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated. Hot water, ASME Section IV Safety Relief.

B. Temperature and Pressure Relief:
   1. ASME approved in accordance with Unfired Pressure Vessel Code, Section 8, UG-136, Safety and Relief Valves. Route discharge to floor.
   2. Manufacturers:
      a. Cla-Val Co: www.cla-val.com.
      b. Henry Technologies: www.henrytech.com.
      c. Watts Regulator Company: www.wattsregulator.com.
      d. Conbraco/Apollo; 18-500.
   3. AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME (BPV IV) certified and labelled.

2.18 STRAINERS

A. Y-type with removable screen; 2 1/2-inch and larger, flanged; 2-inch and smaller, threaded. Rating 125 PSIG.

B. Manufacturers: Crane; Armstrong; Sarco; Hoffman; Leslie; McAlear; Metraflex; Keckley; Muessco; Mueller; Conbraco/Apollo 59 series; Wheatley 'YF', Flow Design YC/YW.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Each type of pipe installed shall be by the same manufacturer thorughout the building.

B. Each type of fittings installed shall be by the same manufacturer throughout the building.

C. Install in accordance with manufacturer's instructions.

D. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

E. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

F. Install piping to maintain headroom, conserve space, and not interfere with use of space.

G. Maintain 4 inch clearance between pipe and fittings after insulation.

H. Group piping whenever practical at common elevations.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 0719.

K. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 3100.

L. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

N. Flush all debris and pipe compound from domestic water system.

O. Install bell and spigot pipe with bell end upstream.

P. Install valves in a readily accessible location.

Q. Install valves with stems upright or horizontal, not inverted.

R. Install water piping to ASME B31.9.

S. Sleeve pipes passing through partitions, walls and floors.Where pipes pass thru exterior walls, seal opening between sleeve and pipe.

T. Pipe discharge of each pressure relief valve individually to floor, unless otherwise noted.

U. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as scheduled.

3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Use double nuts and lock washers on threaded rod supports.
9. Provide copper plated hangers and supports for copper piping where hanger is in contact with tubing.
10. Prime coat concealed steel hangers and supports not provided with a corrosion resistant finish. Refer to Section 22 0510.
11. Support drainage piping within 12 inches of every joint.

3.4 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope.

B. Exterior Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

C. Interior Water Piping: Maintain top of piping level with concentric reducers. Arrange to drain at low points.

3.5 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

B. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.6 SERVICE CONNECTIONS

A. General: Prior to excavation for or installation of any piping, determine location, invert and size at connection. Advise the Architect of any discrepancies discovered.

B. Provide new gas service. Gas service distribution piping to have initial minimum pressure of 2 psi inch wg. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

C. Utilities Impact Fees: the Contractor shall pay utility(s) impact fees, if any, relating to this project.

D. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected to pipign shown on civil drawings with slope for drainage and 3 feet of cover to avoid freezing.

3.7 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe size: 1/2 inches to 1-1/4 inches:
         1) Maximum hanger spacing: 6.5 ft.
         2) Hanger rod diameter: 3/8 inches.
      b. Pipe size: 1-1/2 inches to 2 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 3/8 inch.
      c. Pipe size: 2-1/2 inches to 3 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 1/2 inch.
      d. Pipe size: 4 inches to 6 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 5/8 inch.
   2. Metal Piping:
      a. Copper Pipe size: 1/2 inches to 1-1/4 inches:
         1) Maximum hanger spacing: 5 ft.
         2) Hanger rod diameter: 3/8 inches.
      b. Copper Pipe size: 1-1/2 inches to 4 inches:
         1) Maximum hanger spacing: 8 ft.
         2) Hanger rod diameter: 3/8 inch.
      c. Waste/Vent Pipe size: 2 inches to 3 inches:
         1) Maximum hanger spacing: 8 ft.
         2) Hanger rod diameter: 1/2 inch.
      d. Waste/Vent Pipe size: 4 inches to 6 inches:
         1) Maximum hanger spacing: 8 ft.
         2) Hanger rod diameter: 5/8 inch.

END OF SECTION

SECTION 22 1006

PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Floor Drains

B. Cleanouts

C. Hose Bibbs

D. Hydrants

E. Backflow Preventers

F. Water hammer arrestors

G. Trap Primers

H. Vacuum Breakers

I. Flashing

J. Gas Pressure Reducing Valve

1.2 RELATED REQUIREMENTS

A. Section 22 0510 - General Plumbing Requirements

B. Section 22 0519 - Gages and Meters

C. Section 22 1005 - Plumbing Piping

D. Section 22 4000 - Plumbing Fixtures

E. Section 22 3000 - Plumbing Equipment

1.3 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers; 2001 (R2007).

B. ASME A112.26.1M - Water Hammer Arrestors; The American Society of Mechanical Engineers; 1984.

C. ASSE 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering; 2004 (ANSI/ASSE 1011).

D. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent; American Society of Sanitary Engineering; 2002 (ANSI/ASSE 1012).

E. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers; American Society of Sanitary Engineering; 2005.

F. ASSE 1019 - Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining Type; American Society of Sanitary Engineering; 2004, and Errata 2005 (ANSI/ASSE 1019).

G. PDI-WH 201 - Water Hammer Arresters; Plumbing and Drainage Institute; 2006.

1.4 SUBMITTALS

A. Refer to Section 22 0510 - General Plumbing Requirements, for submittal requirements.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Certificates: Certify that oil interceptors meet or exceed specified requirements.

E. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

F. Operation Data: Indicate frequency of treatment required for interceptors.

G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

H. Maintenance Materials: Furnish the following for the Owner's use in maintenance of project.
1. Extra Loose Keys for Outside Hose Bibbs: One.
2. Extra Hose End Vacuum Breakers for Hose Bibbs: One.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.1 FLOOR DRAINS

A. Floor Drain (FD-A): In Finished Spaces
1. Manufacturers:
a. Josam; Model 30000-S-Y
b. Mifab; Model F1100C-S-P
c. J. R. Smith; Model 2005L(B)
d. Wade; Model W-1100G(TY)
e. Watts; Model FD-100-M-P
f. Zurn; Model Z-415-NL w/ "Type S"
2. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, square, adjustable nickel-bronze strainer.

B. Floor Drain (FD-B): In Mechanical Rooms
1. Manufacturers:
a. Josam; Model 32200-Y
b. Mifab; Model F1340C-Y-14-P
c. J. R. Smith; Model 2130-L
d. Wade; Model W-1200(TY)
e. Watts; Model FD-340-Y-P
f. Zurn; Model Z-505-NL
2. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and adjustable round nickel bronze strainer with removable perforated sediment bucket. Provide 1/2 grate where indicated on drawings.

C. Trench Drain:
1. Manufacturers:
a. ABT Inc. Model Polydrain.
b. Zurn Model Z-882.
c. Strongwell Model Polycast.
d. 12" Wide Pre-Sloped Trench Drain system with interlocking joints, anchor studs, heavy duty cast iron grate, and an outlet at one end of the trench.

2.2 CLEANOUTS

A. Cleanouts at Exterior Surfaced Areas (CO-1):
   1. Manufacturers:
      a. Josam; Model 58190
      b. Mifab; Model C-1450
      c. J.R. Smith; Model 4280
      d. Wade; Model W-8530-G
      e. Watts; Model CO-380
      f. Zurn; Model ZN-1403-NH
   2. Round cast nickel bronze access frame and non-skid cover.

B. Cleanouts at Exterior Unsurfaced Areas (CO-2):
   1. Manufacturers:
      a. Josam; Model 58190
      b. Mifab; Model C-1450
      c. J.R. Smith; Model 4280
      d. Wade; Model W-8530-G
      e. Watts; Model CO-380
      f. Zurn; Model ZN-1403-NH
   2. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

C. Cleanouts at Interior Finished Floor Areas (CO-3):
   1. Manufacturers:
      a. Josam; Model 56000
      b. Mifab; Model C-1100R
      c. J.R. Smith; Model 4031
      d. Wade; Model W-6010
      e. Watts; Model CO-200R
      f. Zurn; Model ZN-1400-IC
   2. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

D. Cleanouts at Interior Finished Wall Areas (CO-4):
   1. Manufacturers:
      a. Josam; Model 58890
      b. Mifab; Model C-1430-RD
      c. J.R. Smith; Model 4472
      d. Wade; Model W-8470R-75
      e. Watts; Model CO-590-RD
      f. Zurn; Model Z-1470-1 w/Z-1469
   2. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

2.3 HOSE BIBBS

A. Interior Hose Bibbs:
   1. Manufacturers:
      a. Nibco; Model 763VB-LS
      b. Woodford; Model 24P
   2. Brass body with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with lockshield and removable key, integral vacuum breaker in conformance with ASSE 1011. Rough brass finish in mechanical spaces.

2.4 HYDRANTS

A. Wall Hydrants: Fully recessed in flush mounting box. Box and door shall be cast bronze.
   1. Manufacturers:
      a. Josam; Model 71000
      b. Wade; Model W-8625
      c. Watts; Model HY-42B
      d. Woodford; Model B65
      e. Zurn; Model Z-1320
      f. Substitutions: See Section 01600 - Product Requirements.
   2. ASSE 1019; freeze resistant, self-draining type with polished bronze lockable recessed box hose thread spout, lockshield and removable key, and integral vacuum breaker.

B. Yard Hydrant:
   1. Manufacturers: (non-freeze, flush with grade)
      a. Josam; Model 71600-76
      b. J.R. Smith; Model 5810
      c. Woodford; Model Y70
      d. Zurn; Model Z-1360
   2. Exposed head, polished bronze 3/4-inch non-freeze type for 2-foot minimum bury, hose thread spout. Mount in center of one foot square protective concrete base.
   3. Description: Plastic preformed rough-in box with brass long shank valves with wheel handles, socket for 2 inch waste, slip in finishing cover.

2.5 BACKFLOW PREVENTERS

A. Reduced Pressure Backflow Preventers:
   1. Manufacturers: (3/4-inch - 2-inch)
      a. Apollo/Conbraco; Model 40-200.
      b. Febco; Model 825Y.
      c. Watts; Model 009.
      d. Wilkins; Model 975XLS.
   2. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; intermediate relief valve non threaded vent outlet; assembled with two quarter turn full port ball valves, bronze strainer, and four test cocks, vent/relief shall be discharged via fixed air gap or funnel. Pipe discharge, full size, to floor drain.

2.6 WATER HAMMER ARRESTORS

A. Manufacturers: Unit Size: 'A'
   1. Jay R. Smith Manufacturing Company; Model 5005.
   2. Watts Regulator Company; Model 15-1/2".
   3. Josam; Model 75001.
   4. Wade; Model W-5.
   5. Zurn Industries, Inc; Model 100.

B. Manufacturers: Unit Size: 'B'
   1. Jay R. Smith Manufacturing Company; Model 5010.
   2. Watts Regulator Company; Model 15*-3/4".
   3. Josam; Model 75002.
   4. Wade; Model W-10.
   5. Zurn Industries, Inc; Model 200.

C. Manufacturers: Unit Size: 'C'
   1. Jay R. Smith Manufacturing Company; Model 5020.
   2. Watts Regulator Company; Model 15-1".

3. Josam; Model 75003.
4. Wade; Model W-20.
5. Zurn Industries, Inc; Model 300.

D. Manufacturers: Unit Size: 'D'
1. Jay R. Smith Manufacturing Company; Model 5030.
2. Watts Regulator Company; Model 15-1 1/4".
3. Josam; Model 75004.
4. Wade; Model W-50.
5. Zurn Industries, Inc; Model 400.

E. Water Hammer Arrestors:
1. ANSI A112.26.1M Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psi working pressure.

2.7 TRAP PRIMERS

A. Single Primer:
1. Cast brass unit with built-in air gap/backflow preventer, 1/2 inch inlet and 1/2 inch outlets.
2. Manufacturers: Precision Plumbing Products (PPP) PR-500, Mifab M-500 w/MI-GAP.
3. See detail on plans.

B. Multiple Trap Primer:
1. Trap Primer Valve: Brass trap primer valve with O-ring seals and integral vacuum breaker. Adjustable from 2 oz. to 5 oz. flow rate.
2. Distribution Unit: Brass body with clear plastic inspection cover top and 4 distribution opening(s) in the bottom.
3. Manufacturers: Precision Plumbing Products, Inc. (PPP) PR-500 w/DU-2/3/4, Mifab M-500 w/MI-GAP and MI-DU. Pipe per manufacturer's instructions.
4. See detail on plans.

2.8 VACUUM BREAKER FOR HOSE CONNECTIONS

A. Interior Only: Chrome plated for plated devices, rough brass elsewhere. Watts 8A, Nidel 34-H, T&S B-972, Wilkins BFB-8, Conbraco 38-304-CS.

B. Exterior Only: Chrome plated for plated devices, rough brass elsewhere. Nidel 34-HD, Watts NF-8 or Conbraco 38-404-03.

2.9 FLASHING

A. Cast Iron Vents Thru Roof Unless Otherwise Noted: Flashing provided by roof manufacturer.

B. Plastic Pipe Vents Thru Roof: Neoprene flashing collar.

C. Cast Iron or Plastic (Schedule 40 P.V.C.) Vent Through Wall:
1. Polished bronze with vandal resistant screws and pipe clamp. Pipe sizes indicated on plans. See detail on plans.
2. Manufacturers
a. J.R. Smith; Model 9005.
b. Josam; Model 88950.
c. Zurn; Model Z-1471.

D. Other Pipe Vents Thru Roof Unless Otherwise Noted: Flashing provided by roof manufacturer.

E. Penetrations Thru Prefabricated Building Roof: Provided by manufacturer.

F. Pipes Thru Roof : See Details.

G. Roof and Overflow Drains: Flashing provided by roof manufacturer.

H. Workmanship: Flashing materials shall be free of holes and splits, and all joints and seams shall be sealed watertight with solder.

2.10 GAS PRESSURE REDUCING VALVE

A. Cast iron body with brass seat; 2 PSI maximum inlet pressure and 10" W.C. outlet pressure. Refer to schedule on drawings. Equimeter, American Meter, Maxitrol Co., or Fisher.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install plumbing specialties in a readily accessible location.

C. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

D. Encase exterior cleanouts in 6-inch concrete pad flush with grade. See detail.

E. Install floor cleanouts at elevation to accommodate finished floor.

F. Floor drains shall be set at 1/8-inch below finish floor elevation. Refer to Architectural for sloping of floor.

G. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, fire sprinkler systems, and irrigation systems.

H. Pipe relief from backflow preventer to nearest drain.

I. Pipe relief from gas regulator to outside. Size as recommended by manufacturer. Provide 4" turn down and insect screen on end of piping.

END OF SECTION

SECTION 22 3000

PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water Heaters

B. Pumps
   1. In-Line Circulators.
   2. Submersible Sump Pumps

1.2 RELATED REQUIREMENTS

A. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment

B. Section 22 0519 - Gages and Meters

1.3 REFERENCE STANDARDS

A. ASME (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers; 2007.

B. NFPA 70 - National Electrical Code; National Fire Protection Association 2005.

1.4 SUBMITTALS

A. Refer to Section 22 0510 - General Mechanical Requirements for submittal procedures.

B. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.
   3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   4. Provide electrical characteristics and connection requirements.

C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in the Owner's name and registered with manufacturer.

E. Certificate: Provide Manufacturer's Certificate in accordance with Article E-67.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

C. Standards: Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:
   1. American Society of Mechanical Engineers (ASME).
   2. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
   3. National Electrical Manufacturers' Association (NEMA).
   4. Underwriters Laboratories (UL).

D. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.6 CERTIFICATIONS

A. Water Heaters: NSF approved.

B. Electric Water Heaters: UL listed and labeled to UL 174 or UL 1453.

C. State of Georgia Certified Inspection of Boilers and Pressure Vessels
   1. The Contractor shall have each boiler inspected in accordance with Georgia Law by a State of Georgia certified inspector upon installation of this equipment. The inspection report shall be submitted to the Georgia Department of Labor, Safety Engineering Section, 1700 Century Circle., Suite 100, Atlanta, Georgia 30345, Attention Mr. Earl Everett, Chief Safety Engineer. The Contractor shall pay all fees associated with the inspections.
   2. Disposition: The Georgia Department of Labor will review the inspection report and their inspection. They will place a tag indicating the state serial number on the inspected piece of equipment and issue a certificate of boiler. The original certificate issued is to be posted in the mechanical room. The contractor shall provide copies to the Architect and the Owner.

D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 WARRANTY

A. Provide warrantees from date of Final Completion.

B. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

C. Provide five year manufacturer warranty for domestic water heaters.

D. Submersible Sump Pump: Provide a one year warranty.

PART 2 PRODUCTS

2.1 WATER HEATERS

A. COMMERCIAL ELECTRIC WATER HEATERS
   1. Manufacturers:
      a. Bradford-White.
      b. P.V.I. (Pressure Vessels Inc.)
      c. A.O. Smith.
   2. Type: Factory-assembled and wired, electric, vertical storage.
   3. Performance:
      a. Storage capacity: 250 gal.
      b. Heating element size: 9 kW.
      c. Number of heating elements: 3.
      d. Minimum recovery rate: 150 gph with 100 degrees F temperature rise.
      e. Maximum working pressure: 150 psig.
   4. Electrical Characteristics:
      a. 480 volts, three phase, 60 Hz.
   5. Tank: Welded steel ASME labelled pressure vessel; glass lining, mounted on steel channel base with lifting lugs, insulated with 2 inch glass fiber; enclosed with 16 gage steel jacket; baked enamel finish.

6. Controls: Ventilated control cabinet, factory-wired with solid state progressive sequencing step controller, fuses, magnetic contactors, control transformer, pilot lights indicating main power and heating steps, control circuit toggle switch, electronic low-water (probe-type) cut-off, high temperature limit thermostat, flush-mounted temperature and pressure gages.
7. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 Watts per square inch.
8. Provide Electronic Proportional Sequencer with indicating lights.

B. WATER HEATER ACCESSORIES
1. IN-LINE CIRCULATOR PUMPS
   a. Manufacturers:
      1) Armstrong Pumps Inc: www.armstrongpumps.com.
      2) Grundfoss.
      3) ITT Bell & Gossett: www.bellgossett.com.
      4) TACO.
   b. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.
   c. Impeller: Bronze.
   d. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
   e. Seal: Carbon rotating against a stationary ceramic seat.
   f. Drive: Flexible coupling.
   g. Performance:
      1) Flow: 3 gpm, at 15 feet head.
      2) Electrical Characteristics:
         (a) 1/8 hp.
         (b) 120 volts, single phase, 60 Hz, 15 minimum circuit ampacity.
2. VACUUM RELIEF VALVES
   a. All bronze construction with stainless steel spring, calibrated with adjustment features for setting valve to relief pressure. Adjustable range 50 - 175 lbs.
   b. Manufacturers: Watts N36, Cash Acme VR-801, Wilkins VR10.
3. DIAPHRAGM-TYPE COMPRESSION TANKS
   a. Manufacturers:
      1) Amtrol Inc: www.amtrol.com.
      2) ITT Bell & Gossett: www.bellgossett.com.
      3) Taco, Inc: www.taco-hvac.com.
   b. Construction: Welded steel, tested and stamped in accordance with ASME (BPV VIII, 1); supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
   c. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 12 psig.
   d. Size: _____ inches diameter, _____ inches overall length, 12.5 gallon capacity.

2.2 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturers:
1. ITT Bell & Gossett; Model _____: www.bellgossett.com.
2. Taco, Inc; Model _____: www.taco-hvac.com.

B. Construction: Welded steel, tested and stamped in accordance with ASME (BPV VIII, 1); supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 12 psig.

D. Size: 11 inches diameter, 15 inches overall length, 6.0 gal capacity.

2.3 PUMPS

A. IN-LINE CIRCULATOR PUMPS
1. Manufacturers:
   a. Armstrong Pumps Inc: www.armstrongpumps.com.
   b. Grundfoss.
   c. ITT Bell & Gossett: www.bellgossett.com.
   d. TACO.
   e. Thrush.
2. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.
3. Impeller: Bronze.
4. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
5. Seal: Carbon rotating against a stationary ceramic seat.
6. Drive: Flexible coupling.
7. Performance:STP1
   a. Flow: 18 gpm, at 45 feet head.
   b. Electrical Characteristics:
      1) 3/4 hp.
8. Performance:CIRC1
   a. Flow: 2 gpm, at 30 feet head.
   b. Electrical Characteristics:
      1) 1/6 hp.

B. SUBMERSIBLE SUMP PUMPS
1. Manufacturers:
   a. Goulds Pumps: www.goulds.com.
   b. Zoeller Pump Company: www.zoeller.com.
   c. Myers Pumps; www.myers.com.
2. Type: Completely submersible, vertical, centrifugal.
3. Casing: Cast iron pump body and oil filled motor chamber.
4. Impeller: Cast iron; open non-clog, stainless steel shaft.
5. Bearings: Ball bearings.
6. Accessories: Oil resistant 6 foot cord and plug with three-prong connector for connection to electric wiring system including grounding connector.
7. Servicing: Slide-away coupling consisting of discharge elbow secure to sump floor, movable bracket, guide pipe system, lifting chain and chain hooks.
8. Controls: Integral diaphragm type level controls with separate liquid level control high level alarm.
9. Performance:
   a. Flow: 50GPM, at 29 feet lift.
   b. Motor: 1 hp, 120 volt, single phase, 60 Hz.

2.4 WATER PRESSURE BOOSTER SYSTEMS

A. WATER PRESSURE BOOSTER SYSTEM
1. Manufacturers:
   a. Tigerflow; Model ES-3000-VFD: www.tigerflow.com.
   b. ITT Bell & Gossett: www.bellgossett.com.
   c. Syncro Flo, Inc: www.syncroflo.com.
2. System: Packaged with two pumps, factory assembled, tested, and adjusted; shipped to site as integral unit; consisting of pumps, valves, and galvanized piping, with control panel assembled on fabricated steel base with structural steel framework.

3. Controls and Instruments: Locate in NEMA 250 Type 1 general purpose enclosure with main disconnect interlocked with door, fused circuit for each motor, magnetic starters with three overloads, control circuit transformer with fuse protection, selector switch for each pump, low limit pressure switch, low pressure alarm light, running lights, current sensing devices, minimum run timers, manual alternation, and suction and discharge pressure gages.
4. Lead Pump: Operate continuously with lag pump operating on system demand. Should lead pump fail to operate, next pump in sequence shall start automatically.
5. Time Delay Relay: Prevent lag pump short cycling on fluctuating demands.
6. Thermal Bleed Circuit with Solenoid Valve: Prevent overheating during low demand.
7. Low Pressure Control: Stop pump operation if incoming water pressure drops to atmospheric.
8. Pump Switch: Permit manual or automatic operation.
9. Valving: Each pump outlet combination pressure reducing and check valve to maintain constant system pressure. Provide gate or butterfly valves on suction and discharge of each pump. Provide check valve on each pump discharge.
10. Time Clock for Automatic Day-Night Changeover:
    a. Day cycle: System shall operate continuously with pressure to fixtures maintained by pressure reducing valves.
    b. Night Cycle: Pump shall operate intermittently on pressure switch located near pressure tank operating pump for pre-determined adjustable time period.
11. Performance:
    a. Flow: 100 gpm, at 63 PSI.
    b. Motors: 5 hp.
    c. Electrical Characteristics:

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Provide dielectric unions between the distribution piping and the cold and hot water connection piping provided with the water heater.

C. Coordinate with plumbing piping and related electrical work to achieve operating system.

D. Domestic Water Heaters:
1. Install water heater on concrete housekeeping base, sized minimum 4 inches larger than heater base. Refer to Section 15010.
2. Pipe relief valves to floor.
3. Pipe drains to nearest floor drain.
4. Install circulator and blenders as detailed on Drawings.

E. Pumps:
1. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
2. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
3. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

F. Submersible Sump Pumps:
1. Ensure shaft length allows sump pumps to be located minimum 24 inches below lowest invert into sump pit and minimum 6 inches clearance from bottom of sump pit.

2. Provide line sized soft seated check valve and isolating valve on discharge.
3. Provide air lock hole between pump discharge and check valve where required by manufacturer.
4. Mount level control in accordance with manufacturer's recommendations.
5. Decrease from line size with long radius reducing elbows or reducers.
6. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

3.2 STARTING EQUIPMENT.

A. Water Heater: Provide services of factory trained representative for minimum one days to start-up, calibrate controls, inspect the installation and instruct the Owner on operation and maintenance.

B. Demonstrate water heater operation and verify specified performance.

C. Sump Pump:
1. Maintain basin is clean and free of debris.
2. Ensure level floats operate free and clear.
3. Adjust level controls.
4. Fill pit with water and mark On-Off levels on pit.

END OF SECTION

SECTION 22 4000

PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water closets

B. Urinals

C. Wall Hung Lavatories

D. Counter Mounted Lavatories

E. Sinks

F. Mop basin

G. Electric water coolers

H. Washing Machine Box

I. Ice Maker Supply Box

J. Emergency Showers and Eye Washes

K. Plumbing Fixtures' Fittings, Accessories, and Supplies

1.2 RELATED SECTIONS

A. Section 22 0510 - General Plumbing Requirements

B. Section 22 0519 - Gages and Meters for Plumbing Piping and Equipment

C. Section 22 0553- Identification for Plumbing Piping and Equipment

D. Section 22 0719 - Plumbing Piping Insulation

E. Section 22 1005 - Plumbing Piping.

F. Section 22 1006 - Plumbing Specialties.

G. Section 22 3000 - Plumbing Equipment.

1.3 REFERENCES

A. ANSI Z124.1 - American National Standard for Plastic Bathtub Units; 1995.

B. ANSI Z124.2 - American National Standard for Plastic Shower Units; 1995.

C. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 1998.

D. ARI 1010 - Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers; Air-Conditioning and Refrigeration Institute; 1994.

E. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; The American Society of Mechanical Engineers; 1997.

F. ASME A112.18.1 - Plumbing Fixture Fittings; The American Society of Mechanical Engineers; 2000.

G. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures; The American Society of Mechanical Engineers; 1994 (R1999).

H. ASME A112.19.2M - Vitreous China Plumbing Fixtures; The American Society of Mechanical Engineers; 1998.

I. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use); The American Society of Mechanical Engineers; 2001.

J. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures; The American Society of Mechanical Engineers; 1994 (R1999).

K. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals; The American Society of Mechanical Engineers; 1999.

1.4 SUBMITTALS

A. Refer to Section 22 0510 - General Plumbing Requirements for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Samples: Submit two lavatory supply fittings.

D. Manufacturer's Instructions: Indicate installation methods and procedures.

E. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in the Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

A. Provide five year manufacturer warranty for electric water cooler from Final Completion.

B. Provide one extra waterless urinal cartridges for each urinal.

PART 2 PRODUCTS

2.1 FLUSH VALVE WATER CLOSETS

A. FIXTURE 'A'; WATER CLOSET (WH, FV(1.6 gpf), STD)
   1. Bowl:
      a. Manufacturers:
         1) American Standard Inc; Model 2257.103: www.americanstandard.com.
         2) Crane; Model 3446
         3) Kohler Company; Model K-4330: www.kohlerco.com.
         4) Toto; Model CT708
         5) Zurn; Model Z5610

b. ASME 112.19.2M; 1.6gpf, wall hung vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud, china bolt caps; standard accessible.

2. Fixture Accessories:
   a. Seat: Type 1St; See SEATS.
   b. Water Closet Carrier: See CARRIERS.
   c. Flush Valve (1.6gpf): Type 3FV; See FLUSH VALVES.

B. FIXTURE 'B'; WATER CLOSET (WH, FV (1.6 gpf), ADA)
1. Bowl:
   a. Manufacturers:
      1) American Standard; Model 2257.103
      2) Crane; Model 3446
      3) Kohler; Model K-4430
      4) Toto; Model CT708
      5) Zurn; Model Z-5610
   b. ASME A112.19.2M; 1.6 gpf, wall hung vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud, china bolt caps; disabled access.
2. Fixture Accessories:
   a. Seat: Type 1St; See SEATS.
   b. Water Closet Carrier: See CARRIERS.
   c. Flush Valve (1.6gpf): Type 3FV; See FLUSH VALVES.

2.2 URINALS

A. FIXTURE 'D'; URINAL (WH, VC, Waterless, ADA)
1. Urinal:
   a. Manufacturers:
      1) Falcon; Model F-1000
   b. ASME A112.19.2M; waterless (no-flush), vitreous china, wall hung urinal fixture with integral trap, replaceable sealant cartridge, wall brackets; disabled accessible.
2. Urinal Carrier: See CARRIERS.

2.3 WALL HUNG LAVATORIES

A. FIXTURE 'F'; LAVATORY (WH, VC, ADA)
1. Lavatory Basin:
   a. Manufacturers:
      1) American Standard; Model 0356.015
      2) Crane; Model 1-410-S
      3) Eljer; Model 051-3561
      4) Kohler; Model K-2006
      5) Toto; Model LT307.1
      6) Zurn; Model Z5341
   b. ASME A112.19.2M; vitreous china, wall hung, 21" x 18" fixture with single hole drilling, front overflow, soap depression, drilled for concealed arm carrier, disabled accessible.
2. Accessories:
   a. Faucet: Type 4F; See FAUCETS.
   b. Drain: Type 2D; See DRAINS.
   c. Supplies: See SUPPLY STOPS.
   d. Trap: Type 1T; See TRAPS.
   e. Carrier: See CARRIERS; Concealed Arm Type.
   f. Insulation: See FIXTURE INSULATION.

2.4 COUNTER MOUNTED LAVATORIES

A. FIXTURE 'E'; LAVATORY (CT, VC, ADA)

1. Lavatory Basin:
   a. Manufacturers:
      1) American Standard; Model 0475.020
      2) Crane; Model 1280S
      3) Eljer; Model 051-0120
      4) Kohler; Model K-2196-1
      5) Toto; Model LT501.1
      6) Zurn; Model Z5111
   b. ASME A112.19.2M; counter mounted, vitreous china, 20" x 17" oval with single hole drilling, front overflow, soap depression, disabled accessible.
2. Accessories:
   a. Faucet: Type 4F; See FAUCETS.
   b. Drain: Type 2D; See DRAINS.
   c. Supplies: See SUPPLY STOPS.
   d. Trap: Type 1T; See TRAPS.
   e. Insulation: See FIXTURE INSULATION.

2.5 COUNTER MOUNTED SINKS

A. FIXTURE 'G'; SINK (SS, CT, 22" x 17" SC, ADA)
   1. Sink:
      a. Manufacturers:
         1) Elkay; Model LRAD-1722
         2) Just; Model SL-ADA-2217-A-GR
         3) Advance-Tabco; Model SS-1-2217-ADA
      b. ASME A112.19.3M; 18 gauge, type 304 stainless steel, single compartment 22 x 17 x 6 -inches overall with 3 -hole drilling for faucet, 3-inch drain opening; ADA accessible.
   2. Accessories:
      a. Faucet: Type 7F; See FAUCETS.
      b. Drain: Type 6D; See DRAINS.
      c. Supplies: See SUPPLIES.
      d. Trap: Type 2T; See TRAPS.
      e. Insulation: See FIXTURE INSULATION.

B. FIXTURE 'H'; SINK (SS, CT, 33" x 22" DC, ADA)
   1. Sink:
      a. Manufacturers:
         1) Elkay; Model LRAD-3322
         2) Just; Model DL-ADA-2233-A-GR
         3) Advance-Tabco; Model SS-2-3322-ADA
      b. ASME A112.19.3M; 18 gauge, type 304 stainless steel, double compartment extra deep 33 x 22 x 6 -inches overall with 4 -hole drilling for faucet, two 3-inch drain openings.
   2. Accessories:
      a. Faucet: Type 8F; See FAUCETS.
      b. Drain: Type 6D; See DRAINS. 2 Required.
      c. Supplies: See SUPPLIES.
      d. Trap: Type 2T; See TRAPS.
      e. Cont. Drain: Type 7D; See DRAINS.
      f. Insulation: See FIXTURE INSULATION.

C. FIXTURE 'J'; SHAMPOO BOWL ASSEMBLY
   1. Shampoo Sink
      a. Manufacturers:
         1) Belvedere; Model 3100

2) Veeco; Model 3000DA

b. ANSI/ASME A112.19.1M; Open , 22x19x10-inch enameled cast iron wall hung sink assembly complete with wall mounting bracket, mixing faucet w/hose spray, vacuum breaker and basket type strainer/drain.

2. Accessories (Manufacturers):
   a. Trap: Type 2T; See TRAPS.
   b. Supplies: See SUPPLIES.
3. Notes:
   a. Provide all necessary piping per manufacturer's recommendations.

2.6 MOP BASINS and SERVICE SINKS

A. FIXTURE 'L']; MOP BASIN (FM, 24" x 24" x 10")
1. Mop Basin:
   a. Manufacturers:
      1) Aquaglass; Model AM-2424
      2) Fiat; Model MSB - 2424
      3) Stern-Williams; Model MTB - 2424
      4) Zurn; Model Z - 1996-24
   b. ASME A112.19.1M one piece homogenous molded basin, 24" X 24" X 10" overall, white, with integral stainless steel grate with quick connect drain.
2. Accessories:
   a. Faucet: Type 11F; See FAUCETS.
   b. Hose & Bracket: Type 12F; See FAUCETS.

2.7 MISCELLANEOUS FIXTURES

A. FIXTURE 'P'; WASHING MACHINE BOX
1. Washing Machine Box Assembly
   a. Manufacturers:
      1) Guy-Gray; Model FB200
      2) Water-Tite; Model MWB-1
   b. 20-gauge white powder-coated metal box, pre-punched, sloped to drain, 2-inch connection, 1/2"-inch FIP hose angle valves; with 18-gauge white powder-coated metal face frame/flange.

B. FIXTURE 'K'; ICEMAKER SUPPLY BOX
1. Icemaker Box Assembly
   a. Manufacturers:
      1) Guy-Gray; Model BIM 875
      2) Water-Tite; Model 9000
   b. 20-gauge steel with powder-coated white finish or polystyrene plastic; 1/2"-inch FIP inlet by 1/4"-inch outlet compression angle valve with 1/2"-inch MPT connection.

2.8 EMERGENCY SHOWERS and EYE WASHES

A. FIXTURE 'N'; EMERGENCY SHOWER AND EYE WASH (Industrial)
1. Manufacturers:
   a. Haws; 8309 WC
   b. Speakman; Model SE-690-ADA
   c. Guardian; Model GBF1909
   d. Water Saver; Model SSBF909
   e. ANSI Z358.1 and ANSI 117.1; ADA shower and eye wash assembly with galvanized steel stanchion, ABS shower head with pull rod & stay-open shower valve; thermostatic mixing valve assembly for providing 'tepid water'.

2.9 ELECTRIC WATER COOLERS and DRINKING FOUNTAINS

A. FIXTURE 'M'; ELECTRIC WATER COOLER (HI-LO)
1. Water Cooler
a. Manufacturers:
1) Elkay; Model EZSTL8 w/ EWF172 Filter
2) Haws; Model HWUAC8L w/ 6426 Filter
3) Halsey-Taylor; Model HAC8BLF-Q ADA PV w/ 8561 & Filter
b. ARI-1010; Bi-level, with ADA unit on the right, wall mounted electric water cooler assembly with stainless steel water surfaces, heavy duty galvanized steel wall mounting frame, 'sandstone' paint or vinyl finish cabinet, elevated anti-squirt bubblers with stream guard, automatic stream regulators; front and side push button actuators; high efficiency cooling tank and air cooled coil delivering 8.0 gph 50-degree water at 90-degree ambient air temperature; internal taste, odor, chlorine and lead filter; CFC and Lead free.
2. Accessories:
a. Supply: See SUPPLY STOPS
b. Trap: Type 1T; See TRAPS
c. Carriers: See CARRIERS

B. FIXTURE 'Q'; WASHFOUNTAIN (WH,"Terrazzo", ADA)
1. Manufacturers:
a. Bradley; Model TDB3103-O-STD-IR-TL-NSD
b. Acorn; Model 3633-2-S0-ST
2. ANSI Z124.3; ANSI Z124.6; ANSI/ICPA SS-1-2001,3-user wash fountain assembly, "Terrazzo" solid surface material, floor mounted with wall water supply & wall trap connections, IR sensor valve, and mounting assembly.
3. Accessories:
a. Supply: Type SS3; See SUPPLIES.
b. Trap: Type 2T; See Traps.

2.10 FIXTURE ACCESSORIES

A. FLUSH VALVES
1. Type 3FV (Standard & ADA Electronic Water Closet Valve- Diaphragm Type)
a. Manufacturers:
1) Sloan; Model 111ES-S
2) Zurn 'Aqua Vantage-Aqua Sense'; Model ZEMS6000AV-WS1-PL-YK
b. ASME A112.18.1; Exposed chrome plated diaphragm type with 120V hardwired infrared sensor operated flush valve with heavy duty cast escutcheon with set screw, integral screwdriver stop, vacuum breaker; 1 1/2 inch top spud, 11 1/2-inches high; 1 solid-ring supports; 1.6 gpf maximum flush.

B. SEATS
1. Type 1St.; Seat (Elongated, open front, less lid, white)
a. Manufacturers:
1) Bemis; Model 1655SSC
2) Beneke; Model 527SS
3) Kohler; Model K-4666-S-C
4) Church; Model 9500SSC
5) Centoco; Model 1500 series
6) Zurn; Model Z-5955-SS-LL
b. Extra heavy weight, injection molded solid plastic, open-front, less lid, molded bumpers, external check hinges and stainless steel posts.

C. FAUCETS

1. Type 4F (Electronic with standard spout - Lavatories)
   a. Manufacturers:
      1) American Standard; Model 6056.205 w/ 605XTMV
      2) Speakman; Model S-8800-TMV-BO-VRS
      3) Symmons; Model S-6080-AC-TMV-FR-SO
      4) Zurn; Model Z-6918E-TMV-1-F
   b. ASME A112.18.1M; Chrome plated brass electronic supply fitting with integral thermostatic mixing valve, 120V powered solenoid operator and infrared sensor with plug in transformer, 0.5 gpm; less grid drain.
2. Type 7F (8-inch spread w/ gooseneck spout - Lavatories or Sinks)
   a. Manufacturers:
      1) American Standard; Model 6530.170
      2) Speakman; Model SC-3004-LD
      3) Chicago; Model 785-GN-2A
      4) Just; Model J-1174-KS
      5) T&S Brass; Model B-867-4
      6) Symmons; Model S-254-LWG
      7) Zurn; Model Z-831-B4
   b. ASME A112.18.1M; Chrome plated brass double service, 8-inch widespread gooseneck lavatory combination supply fitting rigid hi-arc gooseneck spout, aerator; 4-inch wrist handles, 2.2 gpm; less drain.
3. Type 8F (8-inch spread single lever w/spray - Sinks)
   a. Manufacturers:
      1) American Standard; Model 4205.001
      2) Delta; Model 400-WFELHHDF-10
      3) Eljer; Model 4171282
      4) Elkay; Model LK-4101-F
      5) Kohler; Model K-15072-CP
      6) Just; Model J-901
      7) Speakman; Model S-3761-HS
      8) Zurn; Model Z-82300-CP-8-HS
   b. ASME A112.18.1M; Chrome plated brass double service, 8-inch widespread, single lever w/hose spray, swivel spout with aerator; 2.2 gpm.
4. Type 11F (w/ integral stops and vacuum breaker - Mop Basin)
   a. Manufacturers:
      1) American Standard; Model 8344.112
      2) Aquaglass AT-2450
      3) Fiat 830-AA
      4) Stern-Williams T-10-VB
      5) Zurn; Model Z-843M1-RC
   b. ASME A112.18.1M; Chrome plated brass exposed yoke wall-mount utility faucet assembly with integral stops and vacuum breaker, bucket hook and threaded hose end, rough chrome finish.
5. Type 12F (Mop Basin Hose and Bracket)
   a. Manufacturers:
      1) Aquaglass AT-2452
      2) Fiat 832-AA
      3) Stern-Williams T-35
      4) Zurn; Model Z-1996 HH

D. DRAINS
1. Type 2D (Flat grid off-set drain - Lavatories)
   a. Manufacturers:
      1) Eljer; Model 803-0530
      2) Kohler; Model K-13885

3) McGuire; Model 155-WC
4) Zurn; Model Z-8746
5) EBC; Model SG7WC
6) Sanitary-Dash; Model R7308
7) Dearborn; Model 760W

b. ASME A112.18.1M; 1 1/4" inch diameter chrome plated brass flat grid type drain with offset 17-gauge tailpiece.

2. Type 6D (Flat off-set 3 1/2-inch grid - Sinks)
   a. Manufacturers:
      1) Elkay; Model LKAD18
      2) McGuire; Model 1149WC
      3) Zurn; Model Z-8750
      4) EBC; Model SF8WC
      5) Just; Model J-ADA-35-FS
   b. ASME A112.18.1M; 1 1/2" inch diameter chrome plated brass grid type strainer/drain assembly with offset 20-gauge off-set tailpiece.
3. Type 7D (Continuous Drain - 1 1/2"-inch)
   a. Manufacturers:
      1) Elkay; Model LK35
      2) McGuire; Model 111C16G Series
      3) Zurn; Model Z-8750 Series
      4) EBC; Model WE-150L Series
      5) Just; Model J-53-S
   b. ASME A112.18.1M; 1 1/2" inch diameter chrome plated brass, 17-gauge drain assembly for double compartment sinks, complete with slip fit connections.

E. SUPPLY STOPS
1. Type SS1 (3/8"-inch, metal to metal; Loose Key; Lavatories)
   a. Manufacturers:
      1) Kohler; Model K-7607
      2) Chicago; Model 1016-CP
   b. ASME A112.18.1M; Chrome plated brass angle heavy duty stop with metal-to-metal seat and removable actuator key; supply tubing and escutcheon plate.
2. Type SS3 (1/2"-inch, metal-to-metal; Loose Key; Sinks)
   a. Manufacturers:
      1) Kohler; Model K-7608
      2) Chicago; Model 1017-CP
   b. ASME A112.18.1M; Chrome plated brass angle heavy duty stop with metal-to-metal seat and removable actuator key; supply tubing and escutcheon plate.

F. TRAPS
1. Type 1T (1 1/4"-inch Adj. 'P')
   a. Manufacturers:
      1) EBC; Model TA-125-CF
      2) Dearborn; Model 707 DFBN
      3) Kohler; Model K-9000
      4) McGuire; Model 8872
      5) Zurn; Model Z-8700
   b. ASME A112.18.1M; Chrome plated cast brass, 17-gauge P-trap assembly with cast brass nuts, cleanout plug and heavy duty escutcheon.
2. Type 2T (1 1/2"-inch Adj. 'P')
   a. Manufacturers:
      1) EBC; Model TA-150-CF
      2) Dearborn; Model 710 GDFBN
      3) Kohler; Model K-9000

4) McGuire; Model 8912
5) Zurn; Model Z-8702

b. ASME A112.18.1M; Chrome plated cast brass, 17-gauge P-trap assembly with cast brass nuts, cleanout plug and heavy duty escutcheon.

G. CARRIERS
1. Water Closets
a. Type C1
1) Manufacturers:
(a) Josam; Model 12674 or 12684
(b) JR Smith; Model 210-L/R-Y
(c) Mifab; Model MC-10 L/R
(d) Wade; Model 310-NL/R
(e) Watts; Model CA-101-L/R
(f) Zurn; Model Z-1203-NL/R4

b. Type C2
1) Manufacturers:
(a) Josam; Model 12694
(b) JR Smith; Model 220-D-Y
(c) Mifab; Model MC-10D-36
(d) Wade; Model W-310-ND
(e) Watts; Model CA-101-D
(f) Zurn; Model Z-1203-ND4

c. Type C3
1) Manufacturers:
(a) Josam; Model 12764 or 12774
(b) JR Smith; Model 240-L/R-Y
(c) Mifab; Model MC-13-L/R
(d) Wade; Model W-340-NL/R
(e) Watts; Model CA-131-L/R
(f) Zurn; Model Z-1204-1NL/R4

d. Type C4
1) Manufacturers:
(a) Josam; Model 12734
(b) JR Smith; Model 230-Y
(c) Mifab; Model MC-12
(d) Wade; Model W-330-NL
(e) Watts; Model CA-121
(f) Zurn; Model Z-1204-N4

e. Type C5
1) Manufacturers:
(a) Josam; Model 12724
(b) JR Smith; Model 230-D-Y
(c) Mifab; Model MC-12D
(d) Wade; Model W-330-ND
(e) Watts; Model CA-121-D
(f) Zurn; Model Z-1204-ND4

f. Type C6
1) Manufacturers:
(a) Josam; Model 12794 or 12804
(b) JR Smith; Model 250-Y
(c) Mifab; Model MC-13-2
(d) Wade; Model W-340-ANL/R
(e) Watts; Model CA-131-2
(f) Zurn; Model Z-1204-2N4

g. Type C7
   1) Manufacturers:
      (a) Josam; Model 12764 or 12774
      (b) JR Smith; Model 240-L/R-Y
      (c) Mifab; Model MC-13-L/R
      (d) Wade; Model W-340-NL/R
      (e) Watts; Model CA-131-L/R
      (f) Zurn; Model Z-1204-1NL/R4

h. Type C8
   1) Manufacturers:
      (a) Josam; Model 12814
      (b) JR Smith; Model 250-D-Y
      (c) Mifab; Model MC-13D-2
      (d) Wade; Model W-340-AND
      (e) Watts; Model CA-131-D2
      (f) Zurn; Model Z-1204-2ND4

2. Urinals
   a. Type C9
      1) Manufacturers:
         (a) Josam; Model 17800-63
         (b) JR Smith; Model 636-M31
         (c) Mifab; Model MC-31
         (d) Wade; Model W-400-M36
         (e) Watts; Model CA-311-Std.
         (f) Zurn; Model Z-1221

3. Lavatories
   a. Type C10 'Single'
      1) Manufacturers:
         (a) Josam; Model 17100-63
         (b) JR Smith; Model 700-M31
         (c) Mifab; Model MC-41
         (d) Wade; Model 520-36
         (e) Watts; Model CA-411-Std.
         (f) Zurn; Model Z-1231-D
   b. Type C11 'Double'
      1) Manufacturers:
         (a) Josam; Model 17105-63
         (b) JR Smith; Model 700D-M31
         (c) Mifab; Model MC-41-D
         (d) Wade; Model 520-D-M36
         (e) Watts; Model CA-411-D-Std.
         (f) Zurn; Model Z-1231-D

4. Electric Water Coolers
   a. Type C12
      1) Manufacturers:
         (a) Josam; Model 17900
         (b) JR Smith; Model 210-L/R-Y
         (c) Mifab; Model MC-10L/R
         (d) Wade; Model 310-NL/R
         (e) Watts; Model CA-101-L/R
         (f) Zurn; Model Z-1203-NL/R4

5. Carrier Notes:
   a. Carriers shall be manufactured in accordance with ASME A112.18.2 standards.
   b. All single water closet carriers shall be provided with an anchor foot assembly unit. Unit shall be secured to the floor per manufacturer's instructions.

c. All carriers shall be bolted to the floor with lag bolts.
d. All lavatory, urinal and water cooler supports shall have heavy duty rectangular supports.
e. Carriers shall be provided where fixture is mounted on chase wall or mechanical room wall.
f. Auxiliary face plate shall be utilized when the face plate of the carrier is more than 4-inches from the back of the water closet (stud walls) or more than 4-inches from the inside face of the wall (masonry walls).

H. FIXTURE INSULATION
1. Manufacturers:
a. EBC; Model 1K Series
b. McGuire; Model 'Pro-Wrap' Series
c. Plumberex; Model Pro-2000 Series
d. True-Bro; Model 'Lav Guard' Series
e. Zurn; Model 'Trap Wrap' Series
2. Insulation assembly shall be for supply stops & tubing; drains (including off-sets) and P-traps under all ADA lavatories and counter sinks.
3. ANSI A117.1, ADA4.19.4; Fully molded, anti-bacterial flexible vinyl insulation assembly, minimum 1/8"-inch wall thickness, white in color, self-extinguishing meeting ASTM D635, and have a K-value of 1.17.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons, as specified in Fixture Accessories.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

E. Seal wall and floor mounted fixtures to wall and floor surfaces with silicon latex tile grout. Joints shall be finished smooth and flush, not depressed. Color to match fixture.

F. Pipe runout from urinal to waste stack shall be Brass or Schedule 40 PVC piping. Copper piping shall not be used.

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING AND PROTECTION

A. Clean plumbing fixtures and equipment.

B. Do not permit use of fixtures.

3.7 SCHEDULES

A. Refer to Fixture Schedule on plans for mounting heights and piping connections.

END OF SECTION

SECTION 22 6105

COMPRESSED AIR SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe and Pipe Fittings.

B. Air compressor.

C. Refrigerated air dryer.

D. Pressure reducing station.

1.2 RELATED REQUIREMENTS

A. Section 22 0513 - Common Motor Requirements for Plumbing Equipment.

B. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

C. Section 22 0553 - Identification for Plumbing Piping and Equipment: Identification of piping system.

1.3 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

B. ASME B31.1 - Power Piping; The American Society of Mechanical Engineers; 2007 (ANSI/ASME B31.1).

C. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2007.

D. ASTM A 234/A 234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2007.

E. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 1996.

F. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.4 SUBMITTALS

A. Refer to Section 22 0510 - General Plumbing Requirements for submittal procedures.

B. Product Data: Provide manufacturers catalog literature with capacity, weight, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate manufacturer's installation instructions, hoisting and setting requirements, starting procedures.

D. Operation Data: Submit for air compressor, air receiver and accessories, after cooler, refrigerated air dryer, and pressure reducing station.

E. Maintenance Data: Submit for air compressor, air receiver and accessories, after cooler, refrigerated air dryer, and pressure reducing station.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in the Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept air compressors, refrigerated air dryer on site in factory fabricated containers with shipping skids and plastic pipe end protectors in place. Inspect for damage.

B. Protect piping and equipment from weather and construction traffic.

1.7 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for reciprocating air compressors.

PART 2 PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A 234/A 234M, wrought steel welding type.
   2. Joints: Threaded or welded to ASME B31.1.

2.2 VALVES

A. Ball Valves:
   1. Manufacturers:
      a. NIBCO Model T 595 Y.
      b. WATTS Model B-6800.
      c. APOLLO Model 82-100.
   2. MSS SP-110, Class 150, 400 psi CWP, bronze, three piece body, bronze ball, full port, blow-out proof stem, lever handle, threaded ends.

2.3 UNIONS AND COUPLINGS

A. Unions:
   1. Ferrous Pipe: 150 psi malleable iron threaded unions.

B. Flexible Connector: Neoprene with brass threaded connectors.

2.4 COMPRESSOR

A. Manufacturers:
   1. Gardner Denver, Inc. (Champion); Model HR15DF-25: www.gardnerdenver.com.
   2. Ingersoll Rand Compressed Air Solutions: http://air.ingersollrand.com.
   3. Atlas Copco:
   4. Powerex:

B. Type: Duplex compressor unit shall be a self contained unit consisting of two air cooled compressors, electric motors, V-belt drives with totally enclosed belt guards, inlet air filters, air cooled after coolers, dual control regulation, refrigerated air dryer all mounted, except refrigerated dryer, piped and wired on a 250 gallon horizontal air receiver. Each compressor shall have an air cooled after cooler with a fan mounted on the motor to provide a discharge air temperature from the compressor within 15 degrees F of ambient air temperature.

C. Reciprocating Compressors:

1. Unit: The compressor shall be a single stage, single acting, air cooled, reciprocating unit with a cast iron frame, ductile iron crankshaft with oversized, permanently sealed ball bearings, single piece cast iron connecting rods with needle bearings on piston pin end and sealed bearings on crankshaft end, aluminum pistons with three (3) compression rings and two(2) rider bands of Teflon construction, anodized aluminum cylinders and aluminum heads with stainless steel strip valves. Dual cooling provided by the cast iron flywheel and a high efficiency fan V-belt driven by off the crankshaft allows the compressors to operate in continuous duty applications. The compressor shall be V-belt driven with a totally enclosed belt guard mounted on a slotted base for easy belt adjustment.
2. Motor: Constant speed 1800 rpm, NEMA T frame, Class B insulation, 1.5 Service Factor, and grease lubricated ball bearings.
3. Controls:
   a. Control Panel: Duplex panel shall contain, for each compressor, a molded case disconnect switch,with door interlocks, one(1) automatic across-the-line magnetic motor starter with three leg overload protection, one(1) hour meter, one(1) on-off switch, one(1) 120V control power transformer, one(1) reset button, and a control relay alternator to provide automatic alternation and automatic lead/lag operation, all mounted and wired in a NEMA 12 enclosure and shall be UL and CSA approved. Each compressor shall have a high temperature shutdown switch.
   b. Starter: Full with manual reset current overload protection, starter relay, control power transformer, terminal strip for connection to interface equipment.
   c. Safety Controls: Manually reset low oil pressure cutout.
   d. Panel Face: Compressor run light, start-stop switch, elapsed time meter.

D. Capacity:
   1. Continuous Delivery: 98 cfm.
   2. Intake Conditions: Atmospheric.
   3. Discharge Conditions: 175 psig with package capacity of 98 SCFM at 175.0 psig

E. Electrical Characteristics:
   1. 15 HP each compressor. Total capacity 30HP.

F. Motor: Refer to Section 22 0513.

G. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

H. Disconnect Switch: Factory mount disconnect switch in control panel.

2.5 AIR DRYER

A. Manufacturers:
   1. Gardner Denver, Inc. (Champion); Model CRN-100.
   2. Ingersoll Rand Compressed Air Solutions
   3. Atlas Copco
   4. Powerex

B. Type: Self contained mechanical refrigeration type complete with heat exchanger, refrigeration compressor, automatic controls, timer motor controlled moisture removal trap, internal wiring and piping, and full refrigerant charge.

C. Air Connections: Inlet and outlet connections at same level, factory insulated.

D. Heat Exchangers: Air to air and refrigerant to air coils. Provide heat exchangers with automatic control system to bypass refrigeration system on low or no load condition.

E. Moisture Separator: Centrifugal type located at discharge of heat exchanger.

F. Refrigeration Unit: Hermetically sealed type to operate continuously to maintain specified 21 degrees F dew point. House unit in steel cabinet provided with access door and panel for maintenance and inspection.

G. Accessories: On/off switch, high temperature light and power on light.

H. Capacity:
   1. Discharge Air: 38 degrees F atmospheric dew point.
   2. Rated Air Flow: 100 cfm.
   3. Inlet Air Pressure: 175 psi.

I. Motor: Refer to Section 22 0513.

J. Controls:.

K. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

L. Disconnect Switch: Factory mount disconnect switch in control panel.

M. Cord and Plug: Provide unit with 6 foot cord and plug for connection to electric wiring system including grounding connector.

2.6 PRESSURE REDUCING VALVE

A. Manufacturer: ARO; Model 2734-7-2-0-0.

B. Other acceptable manufacturers offering equivalent products.

C. Pressure Reducing Station: Consisting of automatic reducing valve and bypass, and low pressure side relief valve and gage.

D. Valve Capacity: Reduce pressure from 200 psi to 30 psi, adjustable upwards from reduced pressure.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Install compressor unit on concrete inerta pad. Refer to Sections 15010 and22 0548.

C. Install line size gate valve and check valve on compressor discharge.

D. Install replaceable cartridge type filter silencer of adequate capacity for each compressor.

E. Route condensate drains to nearest floor drain.

F. Install valved bypass around air dryer. Factory insulate inlet and outlet connections.

G. Install valved drip connections at low points of piping system.

H. Install takeoffs to outlets from top of main, with shut off valve after take off. Slope take off piping to outlets.

I. Install compressed air couplings, female quick connectors, and pressure gages where outlets are indicated.

J. Identify piping system and components. Refer to Section 22 0553.

3.2 FIELD QUALITY CONTROL

A. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.1.

B. Repair or replace compressed air piping as required to eliminate leaks, and retest to demonstrate compliance.

C. Cap and seal ends of piping when not connected to mechanical equipment.

END OF SECTION

SECTION 23 0510

GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Definitions

B. Submittal Procedures Supplementing Section 01 3000.

C. Operating and Maintenance Manuals

D. Execution Requirements common to Division 23 systems

E. Pipe Sleeves within building

F. Pipe Sleeves in footings and foundations

G. Equipment Bases and Housekeeping Pads

H. Training Requirements

I. Cleaning Requirements.

J. Finishing Requirements

1.2 RELATED SECTIONS

A. Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Section 01700 - Execution Requirements, for additional submittal and warranty requirements.

C. Section 07840 - Fire Stop Systems.

D. Section 07900 - Joint Sealers.

1.3 ALTERNATIVES

A. Refer to Section 01 0300 - Alternatives, for product alternatives affecting this Division.

1.4 DEFINITIONS

A. Manufacturer's Representatives: Wherever MANUFACTURER'S REPRESENTATIVE is referred to in this division, said representative shall be regularly employed by the manufacturer to perform similar activities to those called for herein, which indicates his competence in that field of work.

B. Concealed: Where the word concealed is used in this Division, it shall mean items above ceilings, in attics, in crawl spaces, in chases, in tunnels, in cabinet work, and under counters or equipment so as to be not visible from an elevation of 5 feet at a horizontal distance of 10 feet.

C. Finished Spaces or Areas: Where finished spaces or areas are referred to in this Division, it shall mean all spaces except concealed spaces, mechanical rooms, or boiler rooms unless otherwise noted.

D. Provide: Furnish and install.

E. Control and Interlock Wiring: All wiring, both line voltage and low voltage, other than power wiring from an electrical distribution panel, through the primary control device, to the item of equipment.

F. Primary Control Device: That ONE device for any item of equipment which interrupts power flow during normal operation. Where magnetic starters are provided, they are the primary control. For items not switches by starters, the primary control device will be that ONE thermostat, time clock, manual switch, aquastat, P.E. switch, or relay performing the primary switching.

G. Diagrammatic: A drawing that shows arrangement and relations (as of parts).i.e: A diagrammatic drawing uses symbols rather than pictorial representation of pipes, ducts, conduit and other items shown and is not necessarily to scale. Arrangement, location, and sizes shown are firm.

H. Readily Accessible: Items requiring maintenance shall be available for close approach for maintenance or use in a space, through an access door from floor elevation, or above a lay-in ceiling though an access point by maintenance staff safely standing on a ladder no taller than the ceiling.

I. Noted, Indicated or Shown: Where the terms "Noted", "Indicated" or "Shown" are used in these specifications, the words "in the specifications or on the plans" shall be inferred.

J. Detail: Where reference is made to a Detail, the Detail shall be on the plans unless otherwise noted.

K. Specifications: Where reference is made to these specifications, it shall be inferred in this Division of specifications.

L. Notification by the Contractor, and Instructions to the Contractor: Where reference is made in these specifications to notification by or instructions given to the Contractor, it shall be inferred that the Architect shall be the instructor or shall be notified, as the case exists.

M. Division or Section Reference: Where reference is made to another Division or Section within this Division, refer to specifications table of contents for Division, Section, or Page Number.

N. Flow Diagram: A single-line, two-dimension, non-scaled drawing depicting arrangement and sequence of equipment, valves, controls, thermometers, gauges, and other specialty devices in a pipe or duct system.

1.5 REGULATORY REQUIREMENTS

A. Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.

B. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.

C. Plumbing: Conform to the Georgia State Minimum Standard Plumbing Code (International Plumbing Code), 2006 Edition, with 2007, 2008 & 2009 Georgia State Amendments.

D. Fire Prevention Precautions in Cutting and Welding Areas: Conform to Article 2605 Fire Prevention Precautions, Georgia State Minimum Standard Fire Prevention Code (International Fire Code), 2006 Edition, with 2007 Georgia State Amendments, for all work involving cutting and welding.

E. HVAC: Conform to the Georgia State Minimum Standard Mechanical Code (International Mechanical Code), 2006 edition with 2007 and 2008 Georgia State Amendments.

F. Energy: Conform to the Georgia State Energy Code for Buildings (International Energy Conservation Code), 2006 Edition, with 2008 & 2009 Georgia State Amendments.

G. Electrical: Refer to Division 26. Conform to the National Electrical Code, NFPA 70, 2008 with 2009 Georgia State Amendments.

H. Building Code: Conform to the Georgia State Minimum Standard Building Code (International Building Code), 2006 Edition with 2007 & 2009 Amendments.

1.6 PERFORMANCE REQUIREMENTS

A. Requirements specified herein are minimum. All equipment, when installed, shall perform equal to or exceed specified requirements.

1.7 VALUE ENGINEERING

A. Where the Contractor is requested to offer or make Value Engineering suggestions as a means of reducing the Project Cost, the Contractor shall present suggestion in the format prescribed herein.

B. Provide each suggestion in writing referencing the specific element involved, ie. specification article and/or drawing/detail number(s).

C. State how the proposed change impacts the project, ie. change in life expectancy, increased operating costs, etc. in addition to the reduction of first cost (Amount of cost reduction.).

D. State how the change will impact the Construction Schedule.

E. Where the change impacts the contract drawing(s), provide a sketch of the proposed change to assist in the evaluation process. If the suggestion is approved, the Contractor shall provide a drawing, as a part of the shop drawing process, showing the Contractor's proposed changes.

F. Each suggestion shall include specific language commenting that the proposed change has been or has not been successfully made previously one or more similar projects.

1.8 SUBMITTALS

A. Supplementing Division 1 requirements; the Contractor shall:
   1. Review the submittal data and check to ensure compliance with specifications prior to submitting.
      a. The Contractor agrees that submittals of equipment and material and shop drawings of equipment and material layouts required under provisions of these specifications and processed by the Architect are not Change Orders. The purpose of submittals is to demonstrate that the Contractor understands the design concept of the project by indicating the equipment and materials he intends to furnish and install, and by detailing the installation he intends to achieve.
      b. The Contractor shall conform to the requirements of the Contract Documents unless a change order is issued. The Contractor shall identify on each submittal and in letter form to the Architect any and all deviations from the Contract Documents.
      c. Any submittal or shop drawing not conforming to the Contract Documents without this identification and notification shall be assumed to be marked "Revise and Resubmit" (acknowledges this by the submission), and the Contractor shall promptly resubmit said submittal so as to be in full compliance with the Contract Documents.
      d. Failure of the Contractor to provide this information during the shop drawing phase shall make the Contractor responsible for all changes to achieve compliance with the Contract Documents without additional compensation.
   2. Assemble the submittal data in compete sets in hard back three-ring binders, separated by trade, (HVAC), and bound with numbered index sheets and tabs by Specification Sections. Submittal data shall be submitted at one time unless unavailable data such as control submittal would delay project progress, such data shall be identified in a single "early release equipment" list. Data shall include capacities, complete installation instructions, dimensional data and electrical data, BHP, motor HP, operating weights and load distribution at mounting points.

3. Identify all submittals by a cover sheet showing project name, specification sections, drawing or detail number, room number, date, revision date, contractor and subcontractor's organization and project manager with phone number, the model, style and size of item being submitted with manufacturers' representative, salesman (or a preparer who can answer questions), and Preparer's phone number.
4. Manufacturers' standard drawings shall be modified by deletions or additions to show only items applicable to this project.
5. Prepare a master list of submittal proposed to be submitted on the project. This list shall be updated for each submission and shall be the first sheet(s) of the submission in the quantity that is submitted for review. The information and general format shall contain an Tab number, Item Description, Item Status and any comment.
6. Provide a Letter stating that all submittals have been checked for compliance with specifications.

B. Tabulation of Power Wiring Requirements: Within 60 Days of the Notice to Proceed, provide a Tabulation of Power Wiring Requirements of all proposed equipment, including H.P., amps, voltage, phase and KW, tabulated on a separate sheet. A copy of the tabulation shall be transmitted independently to the Contractor, the Architect and to all affected trades. (Refer to Electrical Drawings for electrical provisions for equipment.)

C. Product Data:
1. Provide data specific to the Product proposed indicating capacity data, all standard and optional features to be supplied and all accessories and options available for that product.
2. Manufacturer's standard drawings shall be modified by deletions or additions to show only items applicable to this project.

D. Warranty: Submit the Contractor's warranty letter addressed to the Owner stating the correct project name and number, if applicable, the warranty period and ensure that form has the correct date of the Final Observation.

1.9 OPERATING AND MAINTENANCE MANUALS

A. Three (3) bound and indexed Operating and Maintenance Manuals shall be prepared by the Contractor for all equipment and be submitted for approval a minimum of prior to the Final Inspection. Two (2) approved copies shall be delivered to the operating personnel.

B. Each Manual shall be compiled as follows:
1. Data shall be bound in smooth surface hard back commercial quality three-ring notebooks with project identification shown on the front cover and binding back. Identification labels shall be typed and adhered with waterproof glue.
2. Notebooks shall have 9-1/2-inch by 11-1/2-inch covers with back width to permit the covers to lie parallel or to converge, and have not less than 1-1/2-inch back width.
3. Index divider sheets of heavy Manila paper shall be inserted between each section of the Manual with a 2-inch x 1/3-inch ready-cut shield tab attached to each sheet for identification of sections.
4. Data sheets and diagrams shall be 8-1/2-inch x 11-inch or be mounted on 8-1/2-inch x 11-inch sheets of 16-pound paper if smaller, with reinforced 11-inch mechanically perforated edges. Drawings and diagrams larger than 8-1/2-inch by 11-inch shall be folded up from the bottom to form a height of 11-inches and folded to the left to form a width of 8-1/2-inches.
5. Table of Contents(Index) sheets shall be provided in the order listed with identifications typed in capital letters.

C. Each Manual shall contain the following information, data and drawings:
1. Copies of submittals (with Engineer's review comments and stamp), equipment and materials.

2. Manufacturer's installation, operating and maintenance instructions for each item of equipment with moving parts including recommended frequency of inspections and maintenance for one years period of time.
3. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.
4. Control diagrams, electrical interlock diagrams, and control valve lists.
5. Copies of as-built shop drawings showing layouts and construction details.
6. Copies of Test and Balance Reports including list of instruments and description of methods employed.

1.10 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Wherever the word "company" or "firm" is used in these subparagraphs, it shall mean the contractor/subcontractor of record for the installations used for proficiency qualification.
   2. Refer to the individual sections within this division for additional installer qualification requirements.
   3. Air-Conditioning
      a. The Contractor expressly warrants that the company performing the installation of the air conditioning systems has demonstrated proficiency in the installation, start-up and adjustment of such systems by the successful performance of work of the nature specified herein on at least three commercial or institutional buildings, each containing minimum of 150 tons capacity or greater with ducted air distribution and chilled water, PTAC, or wall hung units excluded.
      b. The Contractor further warrants that the aforesaid subcontractor, if any, has trained personnel, instruments, tools, and equipment to perform the installation, start-up, instruction and maintenance service specified.
      c. The Contractor also warrants that the aforesaid installer, if any, has been in business performing services of the nature specified herein for at least five years.
   4. Testing and Balancing: Refer to Section 23 0593.

1.11 PRODUCT DELIVERY, STORAGE, AND PROTECTION

A. Accept all products on site in factory-fabricated protective containers. Inspect for damage.

B. Store products in a clean dry place and protect from weather and construction traffic.

C. Handle products carefully to avoid damage to components, enclosures, and finish.

D. After placement, protect products from damage during construction, by all trade contractors.

E. Protect equipment nameplates and labels from damage, being painted, scaring, etc.

1.12 WARRANTY

A. Refer to Section 01 7000 - Contract Closeout, for additional warranty requirements.

B. Where extended warranties beyond the Contractor's one (1) year warranty are specified, the additional warranty time shall start at the end of the Contractor's warranty.

C. Correct defective Work within a one year period after Date of the Final Inspection.

PART 2 PRODUCTS-NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Hazardous Materials:

1. A/E's Responsibility: Plans and specifications have been prepared by the A/E for the Owner without the A/E having conducted investigation as to the presence of asbestos or hazardous waste on the project. Not being a part of this contract, the A/E has not charged any fees and has not and will not advise the Owner with regard to the detection and/or removal of asbestos or hazardous waste. the Owner is aware that asbestos or hazardous waste could be present and will make all decisions with regard to its removal. The removal of all hazardous materials and encapsulation of remaining surfaces is the sole responsibility of the Owner.
2. If the Contractor observes the existence of a friable material which must be disturbed during the course of his work, the Contractor shall promptly notify the Owner and the Architect. the Owner shall make all arrangements regarding testing and removal or encapsulation of asbestos material if present. the Contractor shall not perform any work pertinent to the friable material prior to receipt of special instructions from the Owner through the Architect.
3. "Friable Material" is any material which can be crumbled, pulverized or reduced to a powder by hand pressure when dry.

B. Refer to the specifications and Architectural and Structural drawings for additional requirements pertaining to work under this discipline. Notify the Architect for clarification in the event of conflict.

C. All materials of systems installation exposed in hollow spaces that are used as ducts or plenums shall have a flame spread rating of 25 or less and a smoke development rating of 50 or less.

3.2 PREPARATION

A. Drawings are diagrammatic and show the general proximity of the equipment, ducts, and pipes, etc., are not to be scaled, and do not include all required changes in direction or offsets necessary in coordinating the installation of various materials either between trades or within the same trade. All dimensions shall be verified at the building site. Prefabrication and/or installation of work from drawings shall be at the Contractor's risk. Refer to Architectural plans for exact building dimensions and details.

B. Space Conditions:
1. All apparatus shall fit into the available spaces in the building and must be introduced into the building so as not to cause damage to the structure. Equipment larger than access to equipment spaces shall be disassembled into sub-assemblies for installation.
2. Where deviations from the plans are required in order to conform to the space limitations, such changes shall be made at no additional cost to the Owner and shall be subject to approval.
3. All equipment requiring service shall be made accessible. Coordinate piping and ductwork installation to avoid conflict with other trades.

3.3 DEMOLITION

A. The demolition plans have been prepared to assist the contractor in determining the scope of demolition work and should not be construed to be all of the demolition required. The contractor shall visit job site (after carefully reviewing the contract documents) and determine exact areas and quantities of existing materials to be removed to accomplish new construction.

B. All existing equipment and material removed from the facility shall be the property of the Contractor, unless otherwise noted, and shall be removed from the facility as required by the Contract provisions concerning trash removal.

C. Where the Documents indicate an equipment item to be removed. Remove all associated material including hangers, supports, etc. Do not leave abandoned items.

D. Dispose of any material to be discarded in accordance with all laws and regulations.

E. Existing Refrigerant: Properly remove the existing refrigerant and store in approved containers and store or salvage as required before removing any refrigeration equipment related to this Project.

F. All existing HVAC Equipment and associated appurtenances shall be demolished. Only welding heads abd existing head fans and associated louvers and controls shall be reused in new construction.

3.4 INSTALLATION

A. Clearance above and in front of electrical switchgear, electrical power panels or control panels shall be maintained by mechanical systems so that no mechanical ducts, pipes, vents or equipment is routed above or across the space directly above this equipment in conformance with the National Electrical Code.

B. All equipment shall be installed in accordance with manufacturers' published installation instructions shipped with the equipment. In the event there is a discrepancy between these specifications or Drawings and the manufacturers' instructions, no work shall be performed until additional instructions are received.

C. Install and connect all appliances, equipment, and appurtenances as specified, indicated or required in accordance with the manufacturer's instructions and recommendations. Furnish and install complete auxiliary piping, water seals, valves, electric connections, and similar items, recommended by the manufacturer or as required for proper operation.

D. Equipment, valves and other items installed under this division requiring service shall be installed to be readily accessible. Refer to definitions in this section.

E. Coordinate with the Contractor and monitor the progress of the work so that other trades do not obstruct items requiring access for service.

F. After final balancing, equipment with belt drives shall have their belts operating in the mid-80% position of the adjustable sheave.

G. Provide equipment belt and coupling guards shielding the perimeter and face of all new belt drives, shafts and couplings. Provide openings opposite drive and driven shafts to permit use of revolution counter. Guards for fans shall be supported from the fan and mounting base, independent of the floor or housekeeping pad.

H. Route piping and ductwork to avoid skylights, translucent, and transparent ceilings.

I. Pipe Sleeves in Slabs, Masonry Walls and Partitions:
   1. Provide sleeves in all slabs and walls/partitions unless otherwise noted.
   2. Omit sleeves on cast iron pipe through slabs on grade.
   3. Elevated Slabs: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a slab.
   4. Masonry Partitions: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated masonry wall/partition.
   5. Omit sleeves in openings core drilled in masonry partitions.
   6. Rated Drywall Partitions: Twenty gage galvanized steel. Sleeves shall be sized to include the insulation with minimum gap around the insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated drywall wall/partition.
   7. Non-Rated Drywall Partitions: Omit sleeves.

J. Pipe sleeves in footings and foundation walls:
   1. Schedule 40 black steel pipe.
   2. Chilled water, heating water, condenser water, refrigerant, or process piping passing under a footing or through a foundation wall shall be installed in a pipe sleeve, two pipe sizes larger than the pipe passing through.
   3. Sleeves in walls to spaces below grade shall be provided with 10 gauge leak plates.

K. Seal sleeves and openings in mechanical room walls, fire rated partitions, and floors above grade vaportight, watertight, or for smoke/fire protection as applicable. Refer to Section 07 2700-Firestopping.

L. Seal sleeves and openings in exterior walls vaportight, or watertight as applicable. Refer to Section 07 9000.

M. Equipment and pipe support upper attachments shall be 3" x 3" x 1/4" steel angles, minimum, spanning structural members unless noted otherwise. Provide inserts and bolts for supporting pipes and equipment from structural members.

N. Saw cut or core drill openings in existing work for the installation of the mechanical system. Patching shall be performed by the trade whose work is cut. Contractor shall lay out and install his work ahead of the work of other trades wherever possible.

3.5 INTERFACE WITH OTHER WORK

A. Space Conditioning during construction:
   1. Coordinate with the Contractor regarding the limits of space conditions specified or requested by other trade sections. Assist the Contractor in the preparation of the construction schedule and determine to what extent the project's HVAC system can be operated within the restrictions listed below to help maintain those conditions.
   2. Ducted air handling systems shall not be placed into operation for testing or for temporary space conditioning until all walls in areas served by the system have been prepared for painting and the building is broom clean.
   3. Provide and maintain filters on all air handling equipment and terminal units used for space conditioning during construction.
   4. Unit heaters, cabinet heaters and finned radiation may be used for temporary heat during construction

3.6 PIPING PRESSURE TESTS

A. General:
   1. Provide 48 hours notification to the Architect in advance of any test.
   2. Complete tests prior to insulating. Leaks shall be repaired, defective materials replaced, and system shall be retested. Strike all joints in copper and steel piping under a pressure test. Conduct tests prior to connecting to equipment or isolate equipment from system.
   3. No water pressure test shall be conducted in freezing weather where subject to freezing.
   4. Test shall be maintained at conditions specified until approved but, in no event, for less than eight (8) hours minimum duration, unless otherwise noted.
   5. Hydrostatic pressure tests shall maintain pressure without change, except that due to temperature change.

B. Chilled Water: Hydrostatic test; 150 PSIG.

3.7 EQUIPMENT BASES and HOUSEKEEPING PADS

A. Provide housekeeping and equipment bases as shown or listed below. Rough up slab under bases before pouring concrete.

B. Materials: Refer to Section 03 3000 - Cast-in-Place Concrete. Omit test cylinders for concrete poured under this section.

C. Bases/Pads shall be rectangular with vertical sides 4-inches from centerline of anchor bolts or 2 inches from edges of equipment supports, whichever provides the larger dimension, side of equipment or base edge, unless otherwise noted.

D. Height:
   1. Pumps on Grade: 12-inch concrete base.
   2. Air Cooled Chiller: Exterior concrete base.
   3. Tanks: 4-inches
   4. Air Handling Units: 8 inches, minimum, unless noted otherwise on Drawings. Increase pad height for unit furnished to provide space for condensate drain trap, refer to trap detail on drawings.
   5. Housekeeping Pads for Other Equipment: 4-inches or as shown on plans.
   6. Condensing Unit (7 Tons and Smaller): Concrete pad, refer to detail.

E. Chamfer: 3/4-inch on edges and corners.

F. Reinforcing: 6"x 6" 10/10 WWF at mid-depth of slab. (4 inch thick pads.)

3.8 STARTING EQUIPMENT AND SYSTEMS

A. Adjust equipment for proper operation within manufacturers' published tolerances.

B. Demonstrate proper operation of systems and equipment to the Owner 's designated representative.

3.9 DEMONSTRATION, TRAINING AND INSTRUCTIONS

A. A manufacturer's service representative shall provide the instructions for each piece of equipment on system when specified in other Sections of this Division. A manufacturer's sales representative is not acceptable. (The instructor shall not be a sales person, but shall have service experience on a continuing basis and be knowledgeable about the subject equipment.)

B. The Using Agency will record (audio or video/audio) operating instructions given by the Contractor to the operating personnel.

C. The Contractor shall request the instruction date not less than 15 days of the desired date for coordination with the Using Agency. Operating manuals for the equipment/systems on which instructions are being given shall be in the possession of the operating personnel not less than 30 days prior to the date of instruction.

3.10 CLEANING and PROTECTION

A. All materials, equipment and mechanical rooms shall be cleaned prior to Final Observation.

B. Wash down and scrub clean all mechanical room floors, walls, equipment bases and equipment.

C. Paint equipment where finish has been damaged requiring retouching of finish to match factory finish.

D. All air handling equipment shall be cleaned internally prior to Final Observation. Clean unit casing externally and internally. Seal/replace all damaged duct liner.

E. Chipped or scraped paint shall be retouched to match original finish.

F. Clean and polish all equipment nameplates. All nameplate information shall be legible.

G. All dents and sags in ductwork and equipment casings shall be straightened.

H. All ductwork, insulation, equipment, pipe, pipe fittings and appurtenances shall be free of dust, rust and stains prior to Final Observation.

3.11 FINISHING MECHANICAL EQUIPMENT AND MATERIAL

A. Use paint systems specified in Division 9 for the substrates to be finished.

B. Paint shop-primed equipment.

C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

D. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

E. Paint all insulated and exposed pipes, unless otherwise indicated.

F. All ferrous fasteners and hanger supports not having a corrosion resistant plated finish shall be painted to prevent rust.

G. Paint all equipment, including that which is factory-finished, exposed to weather or to view on the roof and outdoors.

H. Paint all exposed un-insulated ferrous metals.

I. Paint miscellaneous ferrous metals such as nipples and fittings on chilled water piping at drains, vents and instrument tappings before insulation.

J. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.

K. Paint dampers exposed behind louvers, grilles, to match face panels.

END OF SECTION

SECTION 23 0513

MOTORS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single phase electric motors.

B. Three phase electric motors.

1.2 RELATED REQUIREMENTS

A. Section 23 0514 - Variable Frequency Controllers

B. Section 23 0515 - Enclosed Motor Controllers

C. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 1990 (Reapproved 2000).

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; Institute of Electrical and Electronic Engineers; 2004.

C. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2006.

D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.4 QUALITY ASSURANCE

A. Conform to NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Century, Lincoln, Marathon, Magnetec, Toshiba

2.2 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:
   1. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz.
   2. Motors 1/2/ HP and larger: three phase 60 Hz.
      a. 460 volt motors on 480 volt systems.
   3. Refer to Electrical drawings for voltage and phase required.

B. Overload Protection: Single phase motors shall be furnished with built-in automatic reset overload protection.

C. Efficiency: Motors 1 HP and larger shall be premium efficiency motors and have minimum full load efficiencies not less than listed in the Energy Code.

D. Brake Horsepower: All motors shall have rated horsepower at least 10 percent above the indicated brake horsepower of equipment including belt losses and inlet vane losses.

E. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 40 degrees C environment.
   3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
   4. All copper windings and leads.
   5. Motors for belt driven equipment and base mounted pumps shall have cast iron yoke and bearing housings.

F. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

G. Motors serviced by Variable Frequency Controllers: Motors shall be definite Purpose Inverter Duty Motors complying with NEMA MG-1, Part 31. Stator laminations shall be vacuum-pressure impregnated with varnish for reduction of audible motor noise. Bearings shall be electrically insulated.

H. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.3 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not conform to these specifications.

B. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.

C. Single phase motors for fans, blowers, and pumps: Capacitor start, capacitor run type.

2.4 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.5 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.6 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

I. Sound Power Levels: To NEMA MG 1.

J. Nominal Efficiency: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION

SECTION 23 0514

VARIABLE FREQUENCY CONTROLLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable frequency controllers

1.2 RELATED SECTIONS

A. Section 23 0510 - General Mechanical Requirements

B. Section 23 0513 - Motors for Mechanical Equipment

C. Section 23 0553 - Mechanical Identification

1.3 REFERENCES

A. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems; 1995.

B. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives; 1993.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 1991.

D. IEEE Standard 519 - IEEE Guide for Harmonic Content and Control; 1992.

E. NFPA 70 - National Electrical Code 2008.

1.4 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements, for submittal procedures.

B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

D. Test Reports: Indicate field test and inspection procedures and test results.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Manufacturer's Field Reports: Indicate start-up inspection findings.

G. Operation Data: NEMA ICS 7.1. Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.

H. Maintenance Data: NEMA ICS 7.1. Include routine preventive maintenance schedule.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB ACH550, AC Technology QC3000, Allen Bradley 1352, Eaton IS-5000+, Graham VLT6000, Hitachi J300, Yaskawa E7, Omron VT5 Series, Toshiba E3 Series.

2.2 DESCRIPTION

A. Variable Frequency Controllers: Enclosed controllers suitable for operating the indicated loads, in conformance with requirements of NEMA ICS 7. Select unspecified features and options in accordance with NEMA ICS 3.1.
   1. Employ microprocessor-based inverter logic isolated from power circuits.
   2. Employ pulse-width-modulated inverter system providing a carrier frequency adjustable from 2,000Hz to 8,000Hz.
   3. Design for ability to operate controller with motor disconnected from output.
   4. Design to attempt five automatic restarts following fault condition before automatically bypassing Frequency Controller.

B. Enclosures: NEMA 250, Type 1, suitable for equipment application in places restricted to persons employed on the premises.

C. Finish: Manufacturer's standard enamel.

2.3 OPERATING REQUIREMENTS

A. Rated Input Voltage: 480 volts, three phase, 60 Hertz.

B. Motor Nameplate Voltage: 460 volts, three phase, 60 Hertz.

C. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.

D. Operating Ambient: 0 degrees C to 40 degrees C.

E. Minimum Efficiency at Full Load: 95 percent.

F. Volts Per Hertz Adjustment: Plus or minus 10 percent.

G. Current Limit Adjustment: 60 to 110 percent of rated.

H. Acceleration Rate Adjustment:.5 to 360 seconds.

I. Deceleration Rate Adjustment: 1 to 360 seconds.

J. Input Signal: 4 to 20 mA DC.

2.4 COMPONENTS

A. Display: Provide integral digital display to indicate output voltage, output frequency, and output current.

B. Status Indicators: Separate indicators for overcurrent, overvoltage, ground fault, overtemperature, and input power ON.

C. Furnish HAND-OFF-AUTOMATIC selector switch and manual speed control. Omit on fans with automatic isolation dampers.

D. Include undervoltage release.

E. Control Power Source: Integral control transformer.

F. Door Interlocks: Furnish mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.

G. Safety Interlocks: Furnish terminals for remote contact to inhibit starting under both manual and automatic mode.

H. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic mode.

I. Manual Bypass: Furnish contactor, motor running overload protection, and short circuit protection for full voltage, non-reversing operation of the motor. Include isolation switches to allow maintenance of inverter during bypass operation.

J. Emergency Stop: Use dynamic brakes for emergency stop function.

K. Jogging: On drives serving motors of supply, return, or exhaust fans ducted into one single header duct, provide capability to bring motor up to preset, adjustable, low speed, prior to fan isolation damper opening, signal fan isolation damper to open, then continue to ramp motor up to controlled speed.

L. Disconnecting Means: Include integral circuit breaker on the line side of each controller.

M. Wiring Terminations: Match conductor materials and sizes indicated.

N. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic mode and BACNET communication interface with the BAS.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surface is suitable for controller installation.

B. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.

3.2 INSTALLATION

A. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.

B. Tighten accessible connections and mechanical fasteners after placing controller.

C. Select and install overload heater elements in motor controllers to match installed motor characteristics.

D. Provide engraved plastic nameplates; refer to Section 23 0553 - Mechanical Identification, for product requirements and location.

E. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place in clear plastic holder.

3.3 MANUFACTURER'S FIELD SERVICES

A. Provide the service of the manufacturer's field representative to prepare and start controllers.

3.4 ADJUSTING

A. Make final adjustments to installed controller to assure proper operation of load system. Obtain performance requirements from installer of driven loads.

3.5 DEMONSTRATION

A. Demonstrate operation of controllers in automatic and manual modes.

END OF SECTION

SECTION 23 0515

ENCLOSED MOTOR CONTROLLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Magnetic motor controllers

B. Combination magnetic motor controllers and disconnects

1.2 RELATED SECTIONS

A. Section 23 0510 - General Mechanical Requirements

B. Section 23 0553 - Mechanical Identification: Engraved nameplates

1.3 REFERENCES

A. NECA (INST) - Standard of Installation; National Electrical Contractors Association; 1993.

B. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches; 1993.

C. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association; 1993.

D. NEMA ICS 6 - Industrial Control and Systems: Enclosures; National Electrical Manufacturers Association; 1993.

E. NFPA 70 - National Electrical Code 2008.

1.4 SUBMITTALS

A. Refer to Section 23 0510- General Mechanical Requirements, for submittal procedures.

B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Maintenance Data: Replacement parts list for controllers.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70, 2002 Edition.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Allen Bradley, Cutler Hammer, Furnas, General Electric, Siemens, Square-D.

2.2 AUTOMATIC CONTROLLERS

A. Magnetic Motor Controllers: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.

B. Starters shall be NEMA type starters. IEC type starters are not allowed.

C. Coil Operating Voltage: 120 volts, 60 Hertz.

D. Overload Relays: NEMA ICS 2; bimetal.

E. Enclosures:
   1. Enclosures: NEMA ICS 6, Type 1 indoors.
   2. Enclosures: NEMA ICS 6, Type 3R outdoors.

2.3 ACCESSORIES

A. Refer to HVAC Sequence of Operation for auxiliary contacts and where pushbuttons and remote pushbutton stations are required.

B. Auxiliary Contacts: NEMA ICS 2, 2 field convertible contacts in addition to seal-in contact.

C. Pushbuttons: Recessed type.

D. Indicating Lights: Transformer, incandescent type.

E. Selector Switches: Rotary type Hand-Off-Automatic. Provide unless noted otherwise.

F. Control Power Transformers: 120 volt secondary, 145 VA minimum, in each motor starter. Provide fused primary, secondary, and bond unfused leg of secondary to enclosure.

2.4 DISCONNECTS

A. Combination Controllers: Combine motor controllers with disconnects in common enclosure. Obtain IEC Class 2 coordinated component protection.

B. Thermal Magnetic Circuit Breakers: NEMA AB 1, with integral thermal and instantaneous magnetic trip in each pole.

PART 3 EXECUTION

3.1 INSTALLATION

A. All three phase motors furnished under this Division not fed from a starter in a motor control center or Variable Frequency Controller shall be provided with combination starter and circuit breaker unless otherwise noted.

B. Install enclosed controllers where indicated, in accordance with NECA Standard of Installation.

C. Install enclosed controllers plumb.

D. Height: 4 ft to operating handle.

E. Install with minimum of four anchors.

F. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.

G. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

H. Select and install overload heater elements in motor controllers to match installed motor characteristics.

I. Provide engraved plastic nameplates; refer to Section 23 0553 for product requirements and location.

J. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, voltage/phase rating, panel and circuit number. Place label in clear plastic holder.

END OF SECTION

SECTION 23 0516

EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible pipe connectors.

1.2 RELATED REQUIREMENTS

1.3 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements, for submittal procedures.

B. Product Data:
   1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturer: Southeast Hose Model SEC.

B. Other acceptable manufacturers offering equivalent products.
   1. BOA Model B3-1.
   2. Flexible Metal Hose Co. Model DFC.
   3. Flexonics Model PCS.
   4. Keflex Model KFCS.
   5. Metraflex Model ML.
   6. Twin City Model TCHS.
   7. Wheatley Model SS.

C. Inner Hose: Carbon Steel.

D. Exterior Sleeve: Single braided, stainless steel.

E. Joint: Flanged.

F. Size: Use pipe sized units.

G. Length:
   1. Up To and Including 8 Inches: 24" in length.

H. Maximum offset: 3/4 inch on each side of installed center line.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 23 0519

METERS AND GAGES FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flow meters.

B. Pressure gages and pressure gage taps.

C. Thermometers and thermometer wells.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping.

1.3 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers; 2005.

B. ASTM E 1 - Standard Specification for ASTM Thermometers; 2007.

C. ASTM E 77 - Standard Test Method for Inspection and Verification of Thermometers; 2007.

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Underwriters Laboratories Inc.; 2005.

1.4 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.5 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.1 LIQUID FLOW METERS

A. Chilled water differential pressure flow meter (venturi type):
   1. A coordinated system, including individual Venturi Flow Stations and one Portable Master Meter, supplied by one manufacturer.
   2. Venturi Flow Stations:
      a. Shall be cadmium plated steel butt weld over 8-inches.
      b. Provide with quick disconnect valves, safety shut-off valves, and metal identification tag on chain, giving pipe size, Venturi series, station identification, and meter reading at specified flow rate..
      c. Shall be selected so differential at design flow rate is between 10 and 40 inches W.P. with permanent pressure loss not more than 25% of indicated flow rate differential pressure.
      d. Shall be rated at plus or minus 5.0% accuracy.
   3. Master Meter:
      a. Provide in addition to the capability of being monitored by the DDC control system.
      b. Shall be a 6-inch round, dial, dry type meter with a minimum scale reading 0 to 50 inches of water differential pressure.

c. Provide in a waterproof carrying case with two 10-foot lengths of 1/4-inch high pressure, high temperature connecting hose, quick disconnect socket valves, venting valves, installation and operating instructions and capacity curves.

B. Annular element flow stations:
1. Manufacturers: Ellison Annubar, Barco, Mid-West, Preso.
2. Measuring Station: Type 316 stainless steel pitot type flow element inserted through welded threaded couplet, with safety shut-off valves and quick coupling connections, and permanent metal tag indicating design flow rate, reading for design flow rate, metered fluid, line size, station or location number.
3. Pressure rating: 275 psi.
4. Maximum temperature: 400 degrees F.
5. Accuracy: Plus 0.55 percent to minus 2.30 percent.

2.2 PRESSURE GAGES

A. Manufacturers:
1. Trerice Model 500X.
2. Other acceptable manufacturers offering equivalent products: Duro 102, Marsh 103, Palmer 40SPDLH, Weksler BM1, Weiss AG-1.

B. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
1. Case: Cast aluminum with phosphor bronze bourdon tube, Stem(flangeless) mounting.
2. Size: 4-1/2 inch diameter.
3. Mid-Scale Accuracy: One percent.
4. Hydronic Water Scale: Feet-H2O in 2 ft graduations. Scale range shall be so pump suction pressure is above lower 10% and pump discharge is below upper 10% of scale range.

2.3 PRESSURE GAGE TAPPINGS

A. Ball Valve: 1/4 inch, 400 psig WOG, Bronze two piece body, standard port, chrome plated brass ball, reinforced teflon seats and stuffing box ring, blow-out proof stem design, adjustable packing gland, zinc coated steel lever handle with vinyl hand grip, threaded ends.

B. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections, as manufactured by Trerice, Model 872,Duro, Marsh, Weksler, Weiss.

2.4 STEM TYPE THERMOMETERS

A. Manufacturers:
1. Trerice Model AX9.
2. Weiss Model DVU.
3. Other acceptable manufacturers offering equivalent products: Ashcroft 200-36E, Duro 7EZ3-6, Moeller 706AW, Palmer 9FLA, Weiss 7VS6, Weksler AA5.

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E 1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
1. Size: 7 inch scale.
2. Window: Clear Lexan.
3. Stem: 3/4 inch NPT brass.
4. Accuracy: 2 percent, per ASTM E 77.
5. Calibration: Degrees F.

2.5 DIAL THERMOMETERS

A. Manufacturers:

1. Trerice Model V80341.
2. Other acceptable manufacturers offering equivalent products: Ashcroft 6140TW, Palmer 50B, Weksler 12B25-A11.

B. Thermometers: Dial type vapor or liquid actuated; ASTM E 1; drawn steel with enamel finish case, with brass or copper bulb, copper or bronze braided capillary, white with black markings and black pointer, glass lens.
1. Size: 4-1/2 inch diameter dial.
2. Lens: Clear Lexan.
3. Length of Capillary: Minimum 5 feet.
4. Accuracy: 2 percent.
5. Calibration: Degrees F.

2.6 THERMOMETER SUPPORTS

A. Socket: Brass or stainless steel separable sockets for thermometer stems. Provide cap and chain where not used to mount permanent instrument or control sensor. Provide lagging extension when mounted on insulated pipe.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.7 TEST PLUGS

A. Manufacturers:
1. FDI Model Super Seal.
2. Other acceptable manufacturers offering equivalent products: MG Piping Products Co., Sisco, Trerice, Texas Fairfax, Universal Lancaster.

B. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F. Provide extra long shaft when mounted on insulated pipe.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install flow meters in pipe lines indicated on Drawings with the manufacturer's required straight length of pipe entering and leaving meter.

C. Provide one pressure gage per base mounted pump, installing taps before strainer (Suction Diffuser) and on suction and discharge of pump. Pipe to gage.

D. Install pressure gages on hydronic systems with pulsation dampers. Provide ball valve to isolate each gage connection to system. Extend nipples to allow clearance from insulation.

E. Install pressure tappings on piping where specified or shown on flow diagrams and details. Provide needle valve to isolate each tapping connection to system. Extend nipples to allow clearance from insulation.

F. Install sockets for all thermometers and control sensors. Provide spare sockets with cap and chain as shown on flow diagrams and details.

G. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets.

H. Mount sockets in 3/4 inch NPT pipe openings. Install vertical to 45 degrees off vertical. Use lateral-o-let on vertical pipe.

I. Fill sockets with SAE 10W oil for conduction.

J. Install thermometers in air duct systems on flanges.

K. Locate duct mounted thermometers minimum 10 feet downstream of mixing dampers, coils, or other devices causing air turbulence.

L. Coil and conceal excess capillary on remote element instruments.

M. Provide instruments with scale ranges selected according to service with largest appropriate scale.

N. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

O. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

P. Locate test plugs adjacent to thermometers, temperature wells, pressure gages, coil connections, and where shown on flow diagrams. Install in 1/2 inch pipe opening(minimum), with bushing.

Q. Install test plugs vertical to horizontal. Do not install pointing down.

3.2 SCHEDULE

A. Flow Meters, Location:
   1. Chilled water system.

B. Pressure Gage Tappings, Location:
   1. Chiller - inlets and outlets.

C. Stem Type Thermometers, Location and Scale Range:
   1. Provide thermometers where shown on flow diagrams and details.
   2. Chilled Water, 0 to 100 degrees F in one degree divisions.

D. Dial Thermometers, Location and Scale Range:
   1. Cold Deck of each Air Handling Unit, 0 to 100 degrees F.
   2. Supply Air of each Air Handling Unit, 0 to 100 degrees F.

END OF SECTION

SECTION 23 0548

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vibration isolators.

1.2 SUBMITTALS

A. See Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide schedule of vibration isolator type with location and load on each.

C. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Amber Booth: www.amberbooth.com.

B. Kinetics Noise Control, Inc: www.kineticsnoise.com.

C. Korfund Dynamics: www.thevmcgroup.com.

D. Mason Industries: www.mason-ind.com.

E. Peabody Noise Control: www.mason-ind.com.

F. Vibration Eliminator Co.: www.veco-ny.com.

G. Vibration Mounting and Control: www.vmc-kdc.com.

2.2 VIBRATION ISOLATORS

A. Neoprene Pad Isolators:
   1. Rubber or neoprene waffle pads.
      a. Hardness: 30 durometer.
      b. Thickness: Minimum 1/2 inch.
      c. Maximum Loading: 50 psi.
      d. Rib Height: Maximum 0.7 times width.
   2. Configuration: Single layer.

B. Rubber Mount or Hanger: Molded rubber designed for 0.4 inch deflection with threaded insert.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.2 SCHEDULE

A. Equipment Isolation Schedule.
   1. Suspended fans:
      a. Isolator Type: Rubber Mount or Hanger.
      b. Isolator Deflection:.75 inches.
   2. Air Handling Units mounted on floor slabs above grade: Fan is factory spring isolated. Isolate unit casing from housekeeping pad to reduce vibration from casing.
      a. Isolator Type: Neoprene Pad.
      b. Isolator Deflection:.25 inches.

3. Air Cooled Condensing Units.
   a. Base: Exterior concrete pad.
   b. Isolator Type: Rubber Mount.
   c. Isolator Deflection: 0.25 inches.

END OF SECTION

SECTION 23 0553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Pipe Markers.

C. Valve Tags.

1.2 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.3 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Refer to Section 23 0510- General HVAC Requirements, for submittal procedures.

C. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Champion America, Inc: www.Champion-America.com.

C. Seton Identification Products: www.seton.com/aec.

2.2 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

B. Size:1/2 inch high letters unless otherwise noted.

C. Size when located on ceiling grid: 3/8 inch high letters unless otherwise noted.

2.3 PIPE MARKERS

A. Manufacturers: Brimar, Seton Name Plate Co Setmark, Kolbi Industries Style A thru E(5 inch and smaller) else Style F thru H, Marking Services.

B. Color: Conform to ASME A13.1.

C. Pipe Markers for Indoor Use: Seton Setmark; media indicator with direction-of-flow arrows on calendered vinyl sheet; snap-around type for pipe sizes to 5-7/8 inches diameter, strap around type with nylon ties for pipe sizes 6 inches diameter and larger.

D. Pipe Markers for Outdoor Use: Seton Weather-Code; media indicator and detachable direction-of-flow arrows on weather-resistant pressure-sensitive vinyl sheet; service temperature -40 to 175 degrees F.

2.4 VALVE TAGS

A. Manufacturers: Brimar, Kolbi, Seton.

B. Brass; Media and identification number imprinted on tag.

C. Securing Devices: Number 6 brass bead chain; provide one securing device for each tag in accepted schedule.

D. Valve Chart Frame: Aluminum frame, plastic window; sized to accommodate included chart, 8-1/2 by 11 inches.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

C. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates.

D. Where equipment is located above ceilings; Apply nameplate to ceiling grid adjacent to panel to be removed for access for equipment located above accessible ceilings or to access panel for non-accessible ceilings. Color and legend as follows:
1. Chilled Water Valve: Green with White Letters. "CHILLED WATER VALVE".
2. VAV Boxes: Black with White Letters. "VAV BOX".
3. Fire Dampers: White with Red Letters. "FIRE DAMPER".
4. Smoke Dampers: White with Red Letters. "SMOKE DAMPER".

E. Identify control panels and major control components outside panels with plastic nameplates.

F. Identify air terminal units with plastic nameplates.

G. Tag automatic controls, instruments, and relays. Key to control schematic.

H. Install Pipe Markers on all piping systems at the following Locations:
1. Mechanical Equipment Rooms:
   a. Within 18 inches of each valve.
   b. Within 36 inches of each 90 elbow, tee, connection to equipment or vessel and point where pipe exits room.
   c. At not over 20 feet intervals along all exposed piping.
2. Above Suspended Ceilings:
   a. Within 18 inches of each valve or valve assembly.
   b. At tees, identify both main and branch within 36 inches of tee.
   c. Within 36 inches of each 90 elbow.
   d. At not over 30 feet intervals along all concealed piping.
3. Piping Exposed in Rooms Other Than Mechanical Equipment Areas:
   a. Omit identification on piping, 1 inch exterior diameter or smaller(insulated or uninsulated) or exposed at connections to equipment or plumbing fixtures.
   b. With the above exception, identify at not less than one point each piping run visible in each room, with identification on not over 20 feet intervals.

I. Valve Tags:
1. Install valve tags on all valves in the mechanical equipment rooms.
2. Valve Chart: List all tagged valves indicating system, valve identification number, location and purpose or special information. Mount to wall in mechanical room.

END OF SECTION

SECTION 23 0593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct leakage testing of 4 inch WG pressure class or higher ducts.

B. Initial testing, adjustment, and balancing of air systems.

C. Winter and Summer Seasonal testing, adjustment, and balancing of air systems.

D. Initial testing, adjustment, and balancing of hydronic systems.

E. Winter and Summer Seasonal Testing, adjustment, and balancing of HVAC systems.

F. Measurement of final operating condition of HVAC systems.

G. Testing of control sensors, controllers and safeties.

H. Vibration measurement of equipment operating conditions.

1.2 RELATED REQUIREMENTS

A. Section 23 3100 - Air Duct Accessories.

1.3 REFERENCE STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.

B. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1988, with 1997 Errata.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau; 2005, Seventh Edition.

D. SMACNA HVAC Duct Leakage Test Manual; 1985, First Edition.

1.4 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements for submittal procedures.

B. Submit name of adjusting and balancing agency for approval within 30 days after Notice to Proceed.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Include at least the following in the plan:
      a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      d. Final test report forms to be used.
      e. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

E. Progress Reports.

F. Initial Review: Submit results of testing and balancing agency's examination of documents and systems within 30 days after Notice to Proceed.

G. Initial Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Submit prior to the Contractor's Request for Final Observation.
   2. Submit prior to the Contractor's Request for Substantial Completion.
   3. Submit copies of report for review prior to final acceptance of Project. Provide final copies for the Architect and for inclusion in operating and maintenance manuals.
   4. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
   5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   7. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
   8. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE Std 111, or NEBB forms.
   9. Include the following on the title page of each report:
      a. Name of Testing, Adjusting, and Balancing Agency.
      b. Address of Testing, Adjusting, and Balancing Agency.
      c. Telephone number of Testing, Adjusting, and Balancing Agency.
      d. Project name.
      e. Project location.
      f. Project the Architect.
      g. Project Engineer.
      h. Project the Contractor.
      i. Project altitude.
      j. Report date.

H. Seasonal Reports: Submit seasonal report within 14 days of completion of seasonal adjustments. Include test reports for any equipment that could not be tested at the initial report due to season, temperature or other conditions.
   1. List of deficiencies noted, adjustments made and corrective action taken.
   2. Temperature of each conditioned space and dry bulb setting of controlling thermostat.
   3. Temperature at all sensors in equipment, space duct or pipe and settings of controllers.
   4. Date and outdoor DB and WB range during the time of the seasonal test.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC MN-1, AABC National Standards for Total System Balance.
   2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work and submit Report prior to the Final Observation of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

E. Pre-Qualified TAB Agencies: Testing and Balancing shall be performed by one of the following firms:
   1. Air Analysis of Atlanta.
   2. Air Data, Inc.
   3. Alpha Air Balance.
   4. Atlanta Air Balance.
   5. HVAC Testing Services, Inc.
   6. TAB Services.
   7. Thomas Balancing.

3.2 EXAMINATION

A. Review the contract documents and existing conditions for appurtenances and arrangement for balancing prior to the installation of any equipment or material. the Contractor shall notify the the Architect of any omissions noted within 30 days of the Contractor's notice to proceed.

B. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. All filters are clean and in place. If required, install temporary media in addition to filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place, accessible, operable and open. Report observation on test report.
   8. Smoke dampers are in place, damper and operator are accessible, damper is operable, and open. Report observation on test report.
   9. All dampers and operators function smoothly from shut-off to full open.
   10. Air coil fins are cleaned and combed.
   11. Access doors are installed at specified components are accessible, are closed and duct end caps are in place.
   12. Air outlets are installed and connected.
   13. Duct system leakage is minimized.
   14. Hydronic systems are flushed, filled, and vented.
   15. Pumps are rotating correctly.
   16. Proper strainer baskets are clean and in place.
   17. Service and balance valves are open.

3.3 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Architect to facilitate spot checks during testing.

B. Testing of equipment shall be simultaneous where components of a systems are connected; e.g. DX coil and condensing unit.

3.4 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 5 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Building Pressure: Ensure that installation tolerances result in each floor of the building being positively pressurized with respect to outside ambient pressure.

D. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.5 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.6 AIR SYSTEM PROCEDURE

A. Pressure test ducts in accordance with SMACNA HVAC Air Duct Leakage Test Manual.
1. 4 inch WG or higher: Class 6 for rectangular ducts and Class 3 for round and oval ducts.

B. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

C. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct. Close openings after measurement with permanent manufactured plugs.

D. Measure air quantities at air inlets and outlets.

E. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

F. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

G. Vary total system air quantities by adjustment of fan speeds by drive sheave adjustment. Provide drive changes required to place belt in mid-position at final RPM. Vary branch air quantities by damper regulation.

H. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

I. Measure static air pressure conditions on air supply units, including pressure drops at all components including filters and fans, and total pressure across the fan. Make allowances for 50 percent loading of filters.

J. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions. Adjust operators on outside air dampers to ensure tight seal when shut.

K. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

L. The differential at the time of balance between the outside and return air streams shall be 15 degrees F, minimum, when the outside air quantities are established by temperature differential.

M. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

N. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

O. Air Handler Wide Open Airflow Test:
   1. Test system and limit air flow to a 550 FPM chilled water coil air velocity OR loading of motor to 90% of nameplate, which ever occurs first.
   2. The test shall be performed with all air terminals open to their 100% design airflow (artificially set thermostat setpoints 5 degrees, minimum, below coldest space temperature) and under control.
   3. The purpose of this test is to determine fixed sheave size that shall be provided for the air handler. Provide a new sheave prior upon completion of air flow test and balance work.
   4. The VFD may be used used to temporarily set maximum speed while balancing. Drive shall not be used to provide permanent adjustment. Wide Open maximum speed shall be locked on drive to prevent air flow above maximum.
   5. The Wide Open maximum speed on the VFD shall be locked on drive to prevent air flow above maximum.

3.7 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.8 CONTROL SYSTEM PROCEDURE

A. Low Limit Thermostats, Fire Thermostats, Smoke Detectors and other Safety devices: Test and verify operation. Record setpoint.

B. Sequence of Operation: Operate systems thru specified Sequence and confirm system function.

C. Thermostats, Input/Output sensors and Controls: Measure temperature or flow at device and record measurement and setting of controller.

D. Flow rate transducers: Calibrate flow meters. Confirm accuracy of flow meter by testing thru a four point operating range.

E. Airflow measuring stations: Calibrate flow measuring station. Confirm accuracy by testing thru a four point operating range.

F. Humidistats, Humidity Input/Output sensors and Controls: Measure temperature and relative humidity at device and record measurement and setting of controller.

3.9 BALANCE UNDER SEASONAL OPERATING CONDITIONS

A. After the initial balance has been completed, reviewed and accepted; the contractor shall balance and adjust the system under seasonal operating conditions by performing operational tests over a minimum period of eight hours under both cooling and heating conditions.

B. These tests shall be performed only after each piece of equipment has been individually tested, and is verified to be in correct operating condition, and shall be made at times when outdoor dry bulb temperatures are above 85 F for cooling, or below 50 F for heating.

C. When test is run during the cooling cycle the building must be occupied, and all lights shall be turned on for a minimum of six (6) hours. Doors to all spaces shall be closed and all space thermostats set at its normal setpoint.

D. Purpose: Prove correctness of installation; prove functioning of capacity and safety controls; prove calibration of operating controls; and prove stability of operation under actual loading conditions.

3.10 SCOPE

A. Test, adjust, and balance the following:
1. HVAC Pumps
2. Air Cooled Water Chillers
3. Air Cooled Condensing Units
4. Air Coils
5. Terminal Heat Transfer Units
6. Induction Units
7. Air Handling Units
8. Fans
9. Air Filters
10. Air Terminal Units
11. Air Inlets and Outlets

3.11 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
1. Manufacturer
2. Model/Frame
3. HP/BHP
4. Phase, voltage, amperage; nameplate, actual, no load
5. RPM
6. Service factor
7. Starter size, rating, heater elements
8. Sheave Make/Size/Bore

B. V-Belt Drives:
1. Identification/location
2. Required driven RPM
3. Driven sheave, diameter and RPM
4. Belt, size and quantity
5. Motor sheave diameter and RPM
6. Center to center distance, maximum, minimum, and actual

C. Cooling coil casings: Test the air handling casing(s) downstream of the cooling coils to determine leakage into this section(s) is less than 3.5% of design maximum system air quantity. This infiltration shall be determined as follows:
1. Measure cooling coil leaving air temperature.
2. Measure fan entering air temperature
3. Measure duct supply air fan motor amperage on all legs.
4. At time of measurement, the temperature difference between inside and outside of casing shall be at least 20 degrees .
5. Calculate infiltration percentage and report all values measured for this test

D. Pumps:

1. Identification/number
2. Manufacturer
3. Size/model
4. Impeller
5. Service
6. Design flow rate, pressure drop, BHP
7. Actual flow rate, pressure drop, BHP
8. Discharge pressure
9. Suction pressure
10. Total operating head pressure
11. Shut off, discharge and suction pressures
12. Shut off, total head pressure
13. Plot actual operating point on pump curve chart.

E. Air Cooled Condensers/Condensing Units:
1. Identification/number
2. Location
3. Manufacturer
4. Model number
5. Serial number
6. Entering DB air temperature, design and actual
7. Leaving DB air temperature, design and actual
8. Number of compressors

F. Chillers:
1. Identification/number
2. Manufacturer
3. Capacity
4. Model number
5. Serial number
6. Evaporator entering water temperature, design and actual
7. Evaporator leaving water temperature, design and actual
8. Evaporator pressure drop, design and actual
9. Evaporator water flow rate, design and actual
10. Condenser entering water temperature, design and actual
11. Condenser pressure drop, design and actual
12. Condenser water flow rate, design and actual

G. Cooling Coils:
1. Identification/number
2. Location
3. Service
4. Manufacturer
5. Air flow, design and actual
6. Entering air DB temperature, design and actual
7. Entering air WB temperature, design and actual
8. Leaving air DB temperature, design and actual
9. Leaving air WB temperature, design and actual
10. Water flow, design and actual
11. Water pressure drop, design and actual
12. Entering water temperature, design and actual
13. Leaving water temperature, design and actual
14. Saturated suction temperature, design and actual
15. Air pressure drop, design and actual

H. Heating Coils:

1. Identification/number
2. Location
3. Service
4. Manufacturer
5. Air flow, design and actual
6. Entering air temperature, design and actual
7. Leaving air temperature, design and actual
8. Air pressure drop, design and actual

I. Air Moving Equipment:
1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Arrangement/Class/Discharge
6. Air flow, specified and actual
7. Wide Open Airflow test: airflow and static pressure with all terminals open to 100% design airflow.
8. Return air flow, specified and actual
9. Outside air flow, specified and actual
10. Total static pressure (total external), specified and actual
11. Inlet pressure
12. Discharge pressure
13. Sheave Make/Size/Bore
14. Number of Belts/Make/Size
15. Fan RPM
16. Describe filter condition.
17. Plot actual fan operating point on fan curve chart.

J. Return Air/Outside Air:
1. Identification/location
2. Design air flow
3. Actual air flow
4. Design return air flow
5. Actual return air flow
6. Design outside air flow
7. Actual outside air flow
8. Return air temperature
9. Outside air temperature
10. Required mixed air temperature
11. Actual mixed air temperature
12. Design outside/return air ratio
13. Actual outside/return air ratio

K. Exhaust Fans:
1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Air flow, specified and actual
6. Total static pressure (total external), specified and actual
7. Inlet pressure
8. Discharge pressure
9. Sheave Make/Size/Bore
10. Number of Belts/Make/Size
11. Fan RPM

12. Plot actual operating point on pump curve chart.

L. Duct Traverses:
1. System zone/branch
2. Duct size
3. Area
4. Design velocity
5. Design air flow
6. Test velocity
7. Test air flow
8. Duct static pressure
9. Air temperature
10. Air correction factor

M. Duct Leak Tests:
1. Description of ductwork under test
2. Duct design operating pressure
3. Duct design test static pressure
4. Duct capacity, air flow
5. Maximum allowable leakage duct capacity times leak factor
6. Test apparatus
   a. Blower
   b. Orifice, tube size
   c. Orifice size
   d. Calibrated
7. Test static pressure
8. Test orifice differential pressure
9. Leakage

N. Flow Measuring Stations and Flow Rate Transducers:
1. Identification/number
2. Location
3. Size
4. Manufacturer
5. Model number
6. Serial number
7. Design Flow rate
8. Design pressure drop
9. Actual/final pressure drop
10. Station calibrated setting

O. Terminal Unit Data:
1. Manufacturer
2. Type, constant, variable, single, dual duct
3. Identification/number
4. Location
5. Model number
6. Size
7. Minimum static pressure
8. Minimum design air flow
9. Maximum design air flow
10. Maximum actual air flow
11. Inlet static pressure

P. Air Distribution Tests:
1. Air terminal number
2. Room number/location

3. Terminal type
4. Terminal size
5. Area factor
6. Design velocity
7. Design air flow
8. Test (final) velocity
9. Test (final) air flow
10. Percent of design air flow
11. Relative position of balancing damper

Q. Infra-Red Heaters:
1. Unit designation
2. Size and manufacturer
3. Rating.
4. Gas (CCF) input
5. Verify electric ignition operation
6.

R. Vibration Tests:
1. Location of points:
   a. Fan bearing, drive end
   b. Fan bearing, opposite end
   c. Motor bearing, center (if applicable)
   d. Motor bearing, drive end
   e. Motor bearing, opposite end
   f. Casing (bottom or top)
   g. Casing (side)
   h. Duct after flexible connection (discharge)
   i. Duct after flexible connection (suction)
2. Test readings:
   a. Horizontal, velocity and displacement
   b. Vertical, velocity and displacement
   c. Axial, velocity and displacement
3. Normally acceptable readings, velocity and acceleration
4. Unusual conditions at time of test
5. Vibration source (if non-complying)

S. Space Temperature and Humidity:
1. Temperature and humidity (whether controlled or not) of each conditioned space
2. Setpoint of each controlling thermostat or humidity sensing device.

END OF SECTION

SECTION 23 0713

DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation

B. Duct Liner

C. Insulation jackets

1.2 REFERENCE STANDARDS

A. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.

B. ASTM C 553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2002.

C. ASTM C 1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2005.

D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.

E. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

F. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

1.3 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.2 GLASS FIBER, FLEXIBLE

A. Manufacturers: Certainteed, Knauf, Owens-Corning, JohnsManville.

B. Insulation: ASTM C 553; flexible, noncombustible blanket.
   1. 'K' value: 0.36 at 75 degrees F, when tested in accordance with ASTM C 518.
   2. Maximum Service Temperature: 250 degrees F.
   3. Maximum Water Vapor Sorption: 5.0 percent by weight.
   4. Density: 3/4 lb/cu ft.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E 96/E 96M.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Tie Wire: Annealed stainless steel, 16 gage.

2.3 JACKETS

A. Interior Glass Fabric Vapor Barrier Finish:
   1. Cloth: Untreated 9 oz./sq. yd. weight plain mesh glass cloth.
   2. Blanket: 1.0 lb/cu ft density.
   3. Weave: 5x5.
   4. Lagging Adhesive: Fire resistant compatible with insulation.
   5. Finish: Vinyl emulsion type acrylic, compatible with insulation, white color.

2.4 DUCT LINER

A. Manufacturers: Certainteed Toughguard2, Owens-Corning Aeroflex Plus, JohnsManville Permacote Linacoustic HP.

B. Insulation: Incombustible glass fiber complying with ASTM C 1071; rigid board; impregnated surface and edges coated with acrylic polymer shown to be fungus and bacteria resistant by testing to ASTM G 21.
   1. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
   2. Service Temperature: Up to 250 degrees F.
   3. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
   4. Density: 1.5 pcf.
   5. Minimum Noise Reduction Coefficients:
   6. 1 inch Thickness: 0.45.
   7. 2 inch Thickness: 0.70.

C. Adhesive: Waterproof, fire-retardant type.
   1. Manufacturers:
      a. Benjamin Foster Model 81-60.
      b. Insul-Coustic Model #225.
      c. Manville Model SuperSeal.

D. Liner Fasteners: Galvanized steel, welded with press-on head.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Provide insulation with vapor barrier jackets.

D. Seal all joints, mechanical fastener penetrations, and vapor barrier penetrations with Vapor Barrier Tape

E. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

F. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, duct lined with duct liner, heating coil return bends at terminal units, and expansion joints.

G. Fiber Glass, Flexible:
   1. Do not pull insulation tight around ducts.
   2. Lap transverse joints 2 inch, minimum and secure with staples 18 inches on center.
   3. Wrap insulation with Tie Wire 18 inches on center, maximum.
   4. Install mechanical fasteners not more than 18 inches on center on ducts over 24 inches wide.
   5. Provide 24 inch length, minimum, of rigid glass fiber insulation on bottom of ducts supported from trapeze hangers.

H. Weld mechanical fasteners to duct. No glue or stick on allowed.

I. Rigid duct insulation exposed in the mechanical equipment rooms or Finished Spaces: Finish with glass cloth adhered with fire resistant adhesive and finished with a white breather coating.

J. Duct Liner Locations:
   1. Line supply, return, and mixed air ducts where noted on drawings with 1 inch liner.
   2. Provide 2 inch liner at field fabricated mixing plenums.
   3. Do not install liner in duct within six feet downstream of a cooling coil or outside air intake.

K. Duct Liner Application:
   1. Install liner in accordance with manufacturer's Published Installation Instructions and SMACNA Installation Standards including Figure No. 7-11 and 7-12.
   2. Adhere insulation with adhesive for 90 percent coverage.
   3. Secure insulation with mechanical liner fasteners, type 3 or 4 located in accordance with SMACNA Figure 7-11. Refer to SMACNA (DCS) Standards for spacing.
   4. Install with longitudinal and transverse joints under compression.
   5. Seal and smooth all longitudinal and transverse joints, field cuts exposed edges and any minor surface damage with edge coat.
   6. Seal liner surface penetrations with edge coat.
   7. Provide 26 gauge metal nosing on leading edge at fan discharges and at any interval of lined duct proceeded by unlined duct.
   8. Terminate liner at duct mounted accessories such as turning vanes and dampers. Provide sheet metal "hat" section build out in accordance with SMACNA Figure 7-13.
   9. Duct dimensions indicated are net metal inside dimensions required for air flow. Do not Increase duct size to allow for insulation thickness.
   10. Provide protection for surfaces that may be subject to damage by tradesmen installing electrical, controls or other work.

3.3 CLEANING

A. Clean adjacent surfaces, valves, valve handles, etc of jacketing materials.

3.4 SCHEDULES

A. Exhaust Ducts Within 10 ft of Exterior Openings/Termination:
   1. Concealed and Exposed Above 10ft Above Finished Floor - Glass Fiber, Flexible;2 inch thick.
   2. Exposed Below 10ft Above Finished Floor - Glass Fiber, Rigid. 2 inch thick with glass fabric vapor barrier jacket.

B. Outside Air Intake Ducts:
   1. Concealed and Exposed Above 10ft Above Finished Floor: Glass Fiber, Flexible; 2 inch thick.
   2. Exposed Below 10ft Above Finished Floor: Glass Fiber, Rigid; 2 inch thick with glass fabric vapor barrier jacket.

C. Plenums:
   1. Concealed and Exposed Above 10ft Above Finished Floor: Glass Fiber, Flexible; 2 inch thick.
   2. Exposed Below 10ft Above Finished Floor: Glass Fiber, Rigid; 2 inch thick with glass fabric vapor barrier jacket.

D. Supply Ducts:
   1. Concealed and Exposed Above 10ft Above Finished Floor: Glass Fiber, Flexible; 2 inch thick.
   2. Exposed Supply Ducts in Mechanical Rooms and Non-Conditioned Interior Spaces Below 10ft Above Finished Floor: Glass Fiber, Rigid; 2 inch thick with glass fabric jacket.
   3. Concealed and exposed in Vented Attics, Crawl Spaces or other Spaces at exterior temperature and humidity conditions: Glass Fiber, Flexible; two layers of 2 inch thick.
   4. Exposed Supply Ducts in Conditioned Spaces: Do Not Insulate.
   5. Tops of Ceiling diffusers: Glass Fiber, Flexible; 2 inch thick.
   6. K-Duct: Do not insulate.

E. Return Ducts:
   1. Concealed and Exposed Above 10ft Above Finished Floor Return ducts in Non-Conditioned Space: Glass Fiber, Flexible; 2 inch thick.
   2. Exposed Return Ducts in Non-Conditioned Space Below 10ft Above Finished Floor: Glass fiber, Rigid;2 inch thick with glass fabric vapor barrier jacket.
   3. Return Ducts in Conditioned Space or Return Air Plenum: Do Not Insulate.

END OF SECTION

SECTION 23 0716

HVAC EQUIPMENT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Equipment insulation.

1.2 REFERENCE STANDARDS

A. ASTM C 534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2007a.

B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.

1.3 SUBMITTALS

A. See Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.2 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Armacell International; Model AP: www.armacell.com.
   2. Rubatex.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 3, in sheet form.
   1. Minimum Service Temperature: -40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.

3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

F. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.

G. Flexible Elastomeric Cellular Insulation: Secure sheet insulation with adhesive. Seal Joints with adhesive. Paint exposed insulation with two coats of vinyl insulation paint after adhesive has dried for twelve hours, minimum. Allow two hours, minimum, between coats.

H. Finish insulation at supports, protrusions, and interruptions.

I. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

J. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.3 SCHEDULE

A. Cooling Systems:
1. Pump Bodies: Do not insulate. Refer to detail for drain pan under pump volute.
2. Air Separators: Insulate with 3/4 inch thick flexible elastomeric Insulation.
3. Expansion Tanks: Insulate with 3/4 inch thick flexible elastomeric Insulation.
4. Chiller Cold Surfaces (Not Factory Insulated): Insulate with 3/4 inch thick flexible elastomeric Insulation.
5. Capacitance Tanks: Insulate with 3/4" thick flexible Elastomeric Insulation.

END OF SECTION

SECTION 23 0719

HVAC PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.

B. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2007.

C. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.

D. ASTM C 534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2007a.

E. ASTM C 585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System); 1990 (Reapproved 2004).

F. ASTM C 591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2007.

G. ASTM D 2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2006.

H. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.

I. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association 2007.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; 2003.

1.4 SUBMITTALS

A. See Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. All insulation, mastics, coatings, sealants, and adhesives shall be certified by the manufacturer to be Asbestos-free.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum Three years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.7 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.2 POLYISOCYANURATE CELLULAR PLASTIC

A. Manufacturers: Dow Chemical Trymer 2000XP.

B. Insulation Material: ASTM C 591, rigid molded modified polyisocyanurate cellular plastic.
1. Dimension: Comply with requirements of ASTM C 585.
2. 'K' value: 0.18 at 75 degrees F, when tested in accordance with ASTM C 518.
3. Minimum Service Temperature: -70 degrees F.
4. Maximum Service Temperature: 300 degrees F.
5. Water Absorption: 0.5 percent by volume, maximum, when tested in accordance with ASTM D 2842..
6. Moisture Vapor Transmission: 4.0 perm in.
7. Connection: Waterproof vapor barrier adhesive.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
1. Armacell International; Model AP: www.armacell.com.
2. Halstead.
3. JohnsManville.
4. Rubatex.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 3; use molded tubular material wherever possible.
1. Minimum Service Temperature: -40 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.4 JACKETS

A. Saran Industrial Vapor Retardant Film:
1. Manufacturers: Dow Chemical Co.
2. Material: Polyvinylidene chloride polymer film, 4-mil minimum thickness.
3. Adhesive: Compatible with insulation and jacket.
4. Vapor Retardant Tape: Compatible with film jacket by same manufacturer.

B. ASJ (All Service Jacket): Factory applied white kraft and foil laminate, reinforced, fire retardant jacket (ASJ) with self sealing lap and butt strips. Jackets shall meet the requirements of ASTM C1136.

C. Aluminum Jacket: ASTM B 209 (ASTM B 209M) formed aluminum sheet.
1. Thickness: 0.016 inch sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

D. Glass Fabric Vapor Barrier Finish;
1. Cloth: Untreated 9 oz./sq. yd. weight.

2. Blanket: 1.0 lb/cu ft density.
3. Weave: 5x5.
4. Lagging Adhesive: Fire resistant compatible with insulation.
5. Finish: Vinyl emulsion type acrylic, compatible with insulation, grey color.

2.5 STAPLES, BANDS, AND WIRES

A. Staples shall be outward clinching type of type 304 or 316 stainless steel, or monel.

B. Bands shall be galvanized steel, aluminum, brass, or nickel copper alloy, of 3/4 inch nominal width. The band thickness exclusive of coating shall be not less than 30 gauge for steel and nickel copper alloy.

C. Wire shall be 18-gauge stainless steel.

2.6 ADHESIVES, COATINGS, SEALING COMPOUNDS AND PROTECTIVE FINISHES

A. Lagging Adhesive and Coating for Glass Cloth Jackets and Other Facings - MIL-A-3316 B, Class 1.

B. Lap Adhesive for Vapor Barrier Jacket - MIL-A-3316 B, Class 2.

C. Bonding Adhesives - for securing insulation to metal surfaces - MIL-A-3316 B, Class 2 for temperature up to 200 degree F.

D. Contact Type Adhesive - For installing flexible unicellular insulation - MIL-A-24179, Type II, Class 1.

E. Bedding Compound and Joint Sealers - MIL-B-19564A.

F. Coating Compound - Vapor Barrier Treatment - MIL-C-19565B, Type 1 or II.

G. Protective Finish Outside of Buildings - Coating Compound MIL-C-19565 B, Type I.

H. Manufacturers: Childers, Foster, Armstrong, Mon-Eco.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations. Exterior of insulation shall be uniform in appearance.

D. Insulation jacket shall fit snug to insulation.

E. Valves and fittings:
1. Insulate pipe and all valves and fittings including valve bonnets on A.C. condensate drain, chilled water, and refrigerant suction piping. Leave only valve stems, open ends of wells and gauge cocks exposed.
2. All Other Piping: Insulate pipe and fittings, but omit insulation on unions and valves. Taper insulation ends and cover with jacket material.

F. Insulation at Hangers: Hangers for horizontal, A.C. condensate drain, chilled water, refrigerant suction, and trapeze supports shall be outside of insulation with saddles as specified herein.

G. Saddles: Provide galvanized steel saddles at each point where pipe insulation passes through a hanger or rests on a support. Saddles shall be 180 arc for horizontal piping, 360 arch for vertical piping. Length and gauge of saddle shall be as follows:
   1. 2 inch pipe size and smaller: 18 Gauge saddle, 8 inch long, minimum.
   2. 2-1/2 & 3 inch pipe size: 18 Gauge saddle, 12 inch long, minimum.
   3. 4 inch pipe size: 16 Gauge saddle, 16 inch long, minimum.
   4. 6 inch pipe size and larger: 16 Gauge saddle, 24 inch long, minimum.

H. Flexible elastomeric cellular rubber insulation: Install without splitting and under compression during pipe fabrication. Seal Joints with adhesive. Paint exposed insulation with two coats of vinyl insulation paint after adhesive has dried for twelve hours, minimum. Allow two hours, minimum, between coats.

I. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

J. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

K. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.3 CLEANING

A. Clean adjacent surfaces, valves, valve handles, etc of jacketing materials.

3.4 SCHEDULES

A. DX Cooling Systems:
   1. Refrigerant Suction: 3/4 inch thick preformed flexible elastomeric cellular rubber insulation.

B. Chilled Water systems:
   1. Chilled Water Supply and Return (above grade) Concealed and Exposed Above 10ft Above Finished Floor : 1-1/2 inch thick cellular glass with factory applied all service jacket (ASJ) with self sealing laps or 1-1/2 inch thick polyisocyanurate cellular plastic with Saran 560 vapor jacket. Install pipe insulation over fittings. Where pipe sizes permit, miter insulation to fit at elbows. Provide molded insulation to fit fitting and match piping insulation for larger pipes. Thickness of fitting insulation shall match piping insulation thickness. Finish insulation at elbows with PVC cover where exposed, finish with glass fabric in mastic elsewhere.
   2. Chilled Water Supply and Return (above grade) Exposed Below 10ft Above Finished Floor : 1-1/2 inch thick cellular glass with aluminum jacket or 1-1/2 inch polyisocyanurate cellular plastic with Saran 560 vapor jacket and aluminum jacket. Install pipe insulation over fittings: Where pipe sizes permit, miter insulation to fit at elbows. Provide molded insulation to fit fitting and match piping insulation for larger pipes. Thickness of fitting insulation shall match piping insulation thickness. Finish insulation at elbows with PVC cover where exposed, finish with glass fabric in mastic elsewhere.
   3. Exposed Chilled Water Supply and Return Piping at Air Cooled Chiller: 1-1/2 inch thick cellular glass with aluminum jacket.

C. Condensate Drains from Cooling Coils: 3/4 inch thick preformed flexible elastomeric cellular rubber insulation.

END OF SECTION

SECTION 23 0913

INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Thermostats.

B. Control valves.

C. Automatic dampers.

D. Damper operators.

E. Input/Output Sensors.

F. Miscellaneous accessories.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, gage taps.

B. Section 23 3300 - Air Duct Accessories: Installation of automatic dampers.

C. Section 23 0994 - HVAC Sequence of Operation.

1.3 REFERENCE STANDARDS

A. NEMA DC 3 - Residential Controls - Electrical Wall-Mounted Room Thermostats; National Electrical Manufacturers Association; 2003.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2003.

C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilation Systems; National Fire Protection Association; 2002.

1.4 SUBMITTALS

A. Refer to Section 23 0510- General Mechanical Requirements for submittal procedures.

B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

D. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience employed directly by the digital equipment manufacturer.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.2 AIRFLOW MEASURING STATIONS (AFMS):

A. Fan Inlet Measuring Stations:
   1. Manufacturers: Air Monitor Voluprobe/FI, Paragon FE1050, Tekair B SSK 7000, Ultra Tek Ultrac STK.
   2. Air flow station designed to be mounted in the inlet cone(s) of a DWDI or SWSI centrifugal fan or axial fan to produce an average velocity pressure signal without interfering with or being disturbed by inlet screens, fan shafts, drives, belts or guards.
   3. Accuracy:+5% of span.

B. Duct Measuring Stations:
   1. Manufacturers: Air Monitor, Paragon FE 1500.
   2. Complete with components to provide air straightening, multi-sensoring, self-equalizing, equal area, stationary velocity pressure signals. If a separate air straighteners section is used, provide an access door upstream for cleaning.
   3. Units shall be of metal construction, capable of operating at 400 FPM, minimum, and shall not amplify sound level within duct.
   4. Station shall have permanent pressure loss not exceeding 0.20" W.G. at 2000 FPM.
   5. Station shall have a minimum of one velocity pressure sensor system for every 36 square inches of cross-sectional area. There shall be one static pressure sensor for each total pressure sensor.

C. Outside Air Measuring Stations(AFMS-OA):
   1. Manufacturers: Air Monitor, Ebtron, Paragon FE 1500.
   2. Complete with components to provide air straightening, multi-sensoring, self-equalizing, equal area, stationary velocity pressure signals. If a separate air straighteners section is used, provide an access door upstream for cleaning.
   3. Units shall be of metal construction, capable of operating at 400 fpm, minimum, and shall not amplify sound level within duct.
   4. Station shall have permanent pressure loss not exceeding 0.06" W.G. at 1000 FPM.
   5. Station shall have a minimum of one velocity pressure sensor system for every 36 square inches of cross-sectional area. There shall be one static pressure sensor for each total pressure sensor.

2.3 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gages, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA 250, general purpose utility enclosures with hinged, lockable face panel.

C. Finish: Baked enamel factory finish.

D. Provide common keying for all panels with two keys per control panel.

E. Nameplates:
   1. Use device identification and number from control drawings.
   2. Identify panel with permanent label mounted on panel face. Nameplate shall be bakelite with white letters, 3/8 inch minimum height.
   3. Identify all panel mounted devices with permanent label mounted adjacent to device. Nameplates shall be bakelite with white letters, 1/8 inch minimum height.

F. Door mounted devices: Refer to the Sequence of Operation for devices specified to be door mounted.

G. Wiring:
1. Power supply of capacity required with disconnect switch, surge protection, fuse holder with fuses or circuit breaker, 120 VAC service receptacle.
2. Conductors color coded with both ends identified with manufactured alpha-numeric self-adhesive vinyl tags, 3 mils thick, minimum, keyed to termination points.
3. Connections and junctions to terminal strips and devices only.
4. Route wiring parallel to cabinet side in wiring troughs or laced with nylon ties.
5. Wiring and devices that derive power from other sources shall be located in a separate compartment and be provide with separate terminal strips.
6. Cover all line voltage terminations in panel.

H. Indicator lights: 24 VAC light emitting diode. 100,000 hour lamp life. Provide single "Press-To-Test" button for all lights in panel.

2.4 CONTROL VALVES

A. Globe Pattern:
1. Up to 2 inches: Bronze body, bronze trim, stainless steel rising stem, renewable composition disc, screwed ends with backseating capacity repackable under pressure.
2. Over 2 inches: Iron body, bronze trim, stainless steel rising stem, plug-type disc, flanged ends, renewable seat and disc.
3. Hydronic Systems:
a. Rate for service pressure of 125 psig at 250 degrees F.
b. Replaceable plugs and seats of stainless steel.
c. Packing: EDPM O-ring.
d. Refer to Valve Coefficients indicated on drawings for size.
e. Two way valves shall have equal percentage characteristics. Size two way valve operators to close valves against pump shut off head.

B. Butterfly Pattern:
1. Manufacturers: Bray 31, Centerline Model 200, Crane 12, Grinnell 8000, Hammond 5111, Milwaukee WA, Mueller 51, Nibco WD-2000-3, Stockham LG551.
2. Iron body, aluminum bronze disc, resilient replaceable EDPM seat for service to 180 degrees F wafer or lug ends, stainless steel stem, extended neck.
3. Hydronic Systems:
a. Rate for service pressure of 125 psig at 250 degrees F.
b. Size for 1 psig maximum pressure drop at design flow rate.
4. Electric Actuator:
a. Manufacturers: Bray 70, Grinnell, Johnson.
b. Single phase, permanently split-capacitor, reversible motor with Class F insulation or better with self locking worm gear drive mechanism in enclosure.
c. Enclosure: Water-proof die-cast aluminum cover and base, NEMA-4, 4X, IP 65, polyester powder coated, coupling direct to valve. One power and one control conduit NPT entries.
d. Provide all corrosion resistant (non-ferrous) components, fasteners and mounting devices and connections.
e. Valve status display: Color coded visual indicator to display valve position through full range of travel.
f. SPDT-DB travel limit switches.
g. Manual override with aluminum handwheel.
h. Stainless steel mechanical travel stops.
i. Provide servo control for modulating control sequences.
j. Provide heater with thermostat prewired to terminal block for actuators located in exterior locations.

2.5 CONTROL DAMPERS

A. Manufacturers: Arrow 395, Johnson CD-1300, Ruskin CD-60, National Controlled Air SCD-LL-HD-57, TAMCO-1000.

B. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 16 gage.

C. Blades: Galvanized steel, maximum blade size 8 inches wide, 48 inches long, minimum 16 gage, attached to minimum 1/2 inch shafts with set screws.

D. Blade Seals: Synthetic elastomeric mechanically attached, field replaceable.

E. Jamb Seals: Spring stainless steel.

F. Shaft Bearings: Oil impregnated sintered bronze.

G. Linkage and linkage Bearings: Blade linkage outside of airstream with Oil impregnated sintered bronze bearings.

H. Leakage: Less than one percent based on approach velocity of 2000 ft/min and 4 inches wg.

I. Maximum Pressure Differential: 6 inches wg.

J. Temperature Limits: -40 to 200 degrees F.

2.6 DAMPER OPERATORS

A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
   1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
   2. Provide one operator for maximum 36 sq ft damper section.

B. Electric Operators:
   1. Manufacturers: Belimo AF24 or NF24, Neptune, Johnson Controls.
   2. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.
   3. 24 VAC reversible motor with Class F insulation or better with drive mechanism in enclosure, 10VA maximum..
   4. Feedback Signal: Independent of input signal providing feedback of true position indication.
   5. Enclosure: Aluminum cover and base, NEMA-2, IP 54, coupling direct to damper.
   6. Provide all corrosion resistant (non-ferrous) components, fasteners and mounting devices and connections.
   7. Unit shall be prewired. Provide a conduit fitting and a three foot long appliance cord.
   8. Status display: Visual indicator to display damper position through full range of travel.
   9. External built-in travel limit switch to reverse direction.
   10. Manual override with hex operator.

2.7 FLOW RATE TRANSDUCER(FRT)

A. Manufacturers: Data Industrial, Flow Research, Onicon FB.

B. Probe mounted, low mass rotating element coupled to a transmitter generating a digital pulse train

C. Unit shall be mounted through a corporation stop permitting removal from active pipe and shall impose no more than three foot pressure drop in pipe.

D. Unit coupled with DDC microprocessor shall provide an accuracy within +I% of actual flow rate, regardless of span, between 1/2 FPM minimum flow rate and maximum GPM when installed in line size schedule 40 pipe.

E. Repeatability shall be 0.5% of actual flow rate.

2.8 INPUT/OUTPUT SENSORS

A. Temperature Sensors:
1. Resistance temperature detectors with resistance tolerance of plus or minus 0.1 percent at 70 degrees F, interchangeability less than plus or minus 0.2 percent, time constant of 13 seconds maximum for fluids and 200 seconds maximum for air.
2. Measuring current maximum 5 mA with maximum self-heat of 0.031 degrees F/mW in fluids and 0.014 degrees F/mW in air.
3. Provide 3 lead wires and shield for input bridge circuit.
4. Use insertion elements in ducts not affected by temperature stratification and smaller than 10 square feet. Use averaging elements where larger or prone to stratification sensor length 8 feet or 16 feet as required.
5. Use sensor holder with mounting plate and conduit enclosure with cover plate for elements mounted on ducts. Provide extension between plate and enclosure on insulated ducts.
6. Insertion elements for liquids shall be with brass socket with minimum insertion length of 2-1/2 inches. Provide lagging extensions on insulated pipes.
7. Room digital thermostats: Sensor with setpoint adjustment marked warmer/cooler, built-in override button, terminal block wiring connection and I/O communication port for portable monitoring device. Locking cover. blank cover in all public spaces
8. Outside air sensors: Watertight inlet fitting, shielded from direct rays of sun.

B. Humidity Sensors:
1. Elements: Accurate within 5 percent full range with linear output.
2. Room Sensors: With locking cover matching pneumatic thermostats used, span of 10 to 60 percent relative humidity.
3. Duct and Outside Air Sensors: With element guard and mounting plate, range of 0 - 100 percent relative humidity.

C. Static Pressure Sensors:
1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.
3. Accuracy: One percent of full scale with repeatability 0.3 percent.
4. Output: 0 - 5 vdc with power at 12 to 28 vdc.

D. Equipment Operation Sensors:
1. Status Inputs for Electric Motors:
a. U.L. Listed current sensing relay with split core current transformer, output switch, adjustable mounting bracket, power and trip LED indication.
b. 1 amp @ 30 VAC Adjustable setpoint output switch set to 175 percent of rated motor current with 1 amp @ 30 VAC rating, minimum.
c. Product: Hawkeye H-900, Kele D-150, Veris Industries.

E. Damper Position Indication: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 - 100 percent damper travel.

2.9 SWITCHING DEVICES

A. Duct Mounted Smoke Detector: NFPA 72, photoelectric type with auxiliary SPDT relay contact, key-operated NORMAL-RESET-TEST switch, duct sampling tubes extending width of duct, and visual indication of detector actuation, in duct-mounted housing. Provide two-wire detector with common power supply and signal circuits.

B. Overide(Interval) Timer:
1. Electric, flush mounted, normally open, spring wound, 1 to 12 hours without manual 'ON'(hold) position.

2. Rating: 125 VAC, 20 amp.
3. Manufacturers: Marktime Series 90, Tork C500.

C. Electric Relays:
1. Heavy duty, isolated, cabinet mounted, blade plug-in type with base.
2. Rating: 10 amps, minimum at 125 VAC:

2.10 THERMOSTATS

A. Electric Room Thermostats:
1. Type: NEMA DC 3, 24 volts, with setback/setup temperature control.
2. Service: one step cooling and one step heating.
3. Covers: Locking with set point adjustment, without thermometer.

B. Electric Low Limit Duct Thermostat(Freezestat):
1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint,
2. Provide one thermostat for every 20 sq ft of coil surface.

C. Electric High Limit Duct Thermostat:
1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above setpoint,
2. Bulb length: Minimum 20 feet.
3. Provide one thermostat for every 20 sq ft of coil surface.

D. Fire Thermostats(Firestats):
1. UL labeled, factory set in accordance with NFPA 90A.
2. Normally closed contacts, adjustable setpoint, manual reset, dust cover and adjustable duct mounting flange with extension for mounting on insulated duct.

2.11 TRANSMITTERS

A. Building Static Pressure Transmitter:
1. One pipe, direct acting, double bell, scale range 0.01 to 6.0 inch wg positive or negative, and sensitivity of 0.0005 inch wg. Transmit electronic signal to receiver with matching scale range.

B. Supply Duct Static Pressure Transmitter:
1. One pipe, differential type with temperature compensation, scale range 0.01 to 6.0 inch wg positive or negative, and sensitivity of 0.0005 inch wg. Transmit electronic signal to receiver with matching scale range.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

F. Ensure installation of components is complementary to installation of similar components.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Locate all control devices except for sensors and devices integral to equipment within control panels, unless otherwise noted.

C. Install control devices in a readily accessible location. Refer to definitions in Section 23 0510.

D. Coordinate with the Contractor and monitor the work so that other trades do not obstruct control devices or other items requiring access for service.

E. Device mounting:
   1. All devices shall be permanently mounted and secured in place.
   2. Mount control panels on backboards adjacent to associated equipment on vibration free walls or free standing angle iron supports. Refer to Section 23 0510 for backboards.
   3. Panel mounted controls: Secure to panel backs with non-ferrous sheet metal screws.
   4. Gypsum Board and Plaster walls: Moly-bolt type anchor. No adhesive or plastic insert anchors.
   5. Concrete Walls: Non-ferrous screws and expansion shields.
   6. Concrete masonry units: Mount to recessed box or secure with moly-bolt type anchor.
   7. Provide accessory wall adapter plates where required to cover block or wall opening edges.
   8. Pipe and duct mounted devices: Secure to well or mounting flange. Provide well and flange extensions on insulated duct and pipe to clear insulation thickness.
   9. Mount control valves with stem at or above the horizontal.
   10. Mount dampers with blades horizontal.

F. Identification:
   1. Nameplates: Identify all sensors mounted in mechanical rooms using device ID and number from control drawings with permanent label mounted adjacent to device. Nameplates shall be engraved plastic laminate with uppercase black letters on a white field, 1/4 inch minimum height.
      a. Include sensor type, normal setpoints information on nameplate.
      b. Mounting: Attach nameplates with epoxy cement or non-ferrous screws after final painting.
   2. Color code conductors with both ends identified with manufactured alpha-numeric self-adhesive vinyl tags, 3 mils thick, minimum, keyed to termination points.

G. Electrical wiring:
   1. All control and interlock wiring shall be provided under this section.
   2. No splices between field devices and control panels are permitted.
   3. All Wiring materials and methods shall comply with Division 26 except:
      a. Minimum wire size shall be 14 AWG(copper) for line voltages.
      b. Minimum wire size shall be 18 AWG(copper) for signal.
   4. Fire Alarm System Interface: Signal for fan shutdown shall be obtained from fire alarm output relay located in mechanical room adjacent to the starter/motor control center, unless otherwise noted.
   5. Electric actuators:
      a. Power wiring for controls provided under Division 26 is shown on the Electrical Drawings. Provide conduit, conductors, power supplies and transformers as required for power to operate electric actuators.
      b. The feedback signal for each separately controlled damper actuator shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.

H. Check and verify location of thermostats and exposed control sensors with plans and room details before construction of wall assemblies. Locate between 42 to 48 inches above finished floor. Mount at common elevation within same space. Align with lighting switches. Refer to Section 26 0537.

I. Mount in center of 8x8 inch block face with recessed mounting box and accessory wall adapter plate covering block opening where mounted in concrete masonry units.

J. Mount freeze protection thermostats using flanges and element holders.

K. Use a single sensor for outside air temperature.

L. Mount outdoor thermostats and outdoor sensors indoors, with sensing elements outdoors on north side of building or in shaded location. Mount with sun shield.

M. Mount outdoor thermostats and outdoor sensors away from building discharge openings or doors where conditioned air from building will effect signal. Do not mount on positive pressurized HVAC devices where conditioned air can leak thru opening effecting signal.

N. Provide separable sockets for liquid elements. Mount sockets as specified in Section 23 2113 . Cut element to length for full insertion into well and provide conducting compound.

O. Provide mounting flanges for air bulb elements with extensions as required on insulated ducts to clear insulation.

P. Install current sensing relays in starter enclosure for equipment served.

Q. Provide mixing dampers of opposed blade construction arranged to mix streams. Provide pilot positioners on air damper motors serving modulating dampers over 10 square feet. Provide separate minimum outside air damper section adjacent to return air dampers with separate damper motor. Provide needle type(Shredder) fitting in-line adjacent to operator.

R. Provide isolation (two position) dampers of parallel blade construction.

S. Install damper motors in accessible locations.

T. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.

U. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.

3.3 SCHEDULES

A. Refer to Sequence of Operation for valve normal position and to Drawings for valve coefficients.

B. Refer to Sequence of Operation for damper normal positions.

END OF SECTION

SECTION 23 0923

DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Operator station

B. Digital control equipment.

C. Software.

D. Software set-up and application programming.

1.2 RELATED REQUIREMENTS

A. Section 23 0510 -General Mechanical Requirements-Demonstration, Training and Instructions.

B. Section 23 0514- Variable Frequency Controllers.

C. Section 23 0913 - Instrumentation and Control Devices for HVAC.

D. Section 23 0994 - HVAC Sequence of Operation.

1.3 REFERENCE STANDARDS

1.4 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 23 0913.

E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

F. Provide an interface location to accept a digital connection and interface fully between the control system's local area network and the operator station. System shall allow remote monitoring and access through password protected internet based software.

G. Provide all variable frequency Controllers associated with HVAC equipment controlled by the specified sequence of operation. Refer to Section 23 0514.

H. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

1.5 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements for submittal procedures.

B. Product Data: Provide data for each system component and software module.

C. Shop Drawings:

1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
2. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration diskette containing graphics.
3. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
4. Indicate description and sequence of operation of operating, user, and application software.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

E. Operation and Maintenance Data:
1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

F. Observation by the Architect: Provide an affidavit to the the Architect stating the Controls Systems are performing in accordance with the contract documents prior to Request for Substantial Completion.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience in the direct employ of the equipment manufacturer.

B. Personnel: Mechanics and electricians performing this work shall be regularly engaged in the installation of automatic temperature controls and be in the direct employ of the installing company and shall have a copy of the approved submittal data in immediate possession when performing work.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Siemens Building Technology, Incorporated (Landis & Staefa).

2.2 OPERATOR STATION

A. Work Station:
1. Configuration: IBM-compatible Windows Vista Capable microcomputer system complying with minimum requirements for Windows Vista or better where indicated below. Processor shall be dual core processor type.
2. Minimum memory: 2 Gb RAM.
3. CPU clock speed: 3 GHz.
4. Minimum Clock speed: 1.8 GHz Dual-Core.
5. Cache memory: 2 MB minimum.
6. Display: Super video color graphics adapter (SVGA), 19 inch flat panel LCD color monitor. Minimum 900:1 contrast ratio.
7. Keyboard: Low profile, detachable, having Qwerty layout plus a 10 key numeric keypad, dedicated function keys.
8. Minimum of 2 front mounted USB ports.
9. CD/DVD read/

10. Hard disk drive: 120 Gb minimum.
11. Mouse: Software supported mouse with support software including self building menus and displays of system operations and functions.
12. Modem: Internal type modem or proprietary data modem with cables and communication interfaces required to provide the specified functions, minimum 14,400 bps rate.
13. Printer: Support color printer.
14. Operating System: Windows XP or higher.

B. Printer:
1. Color Inkjet type printer.

2.3 CONTROL UNITS

A. Units: Modular in design and consisting of processor board with programmable RAM memory, local operator access and display panel, and integral interface equipment.

B. Battery Backup: For minimum of 48 hours for complete system including RAM without interruption, with automatic battery charger.

C. All local controller operating parameters, setpoints, and schedules shall be stored in non-volatile EEPROM memory.

D. Arrange Unit and Unit I/O so that control unit functions continue if communications over network are lost.

E. Control Units Functions:
1. Monitor or control each input/output point.
2. Completely independent with hardware clock/calendar and software to maintain control independently.
3. Acquire, process, and transfer information to operator station or other control units on network.
4. Accept, process, and execute commands from other control unit's or devices or operator stations.
5. Access both data base and control functions simultaneously.
6. Record, evaluate, and report changes of state or value that occur among associated points. Continue to perform associated control functions regardless of status of network.
7. Perform in stand-alone mode:
   a. Start/stop.
   b. Automatic Temperature Control.
   c. Event initiated control.
   d. Calculated point.
   e. Scanning and alarm processing.
   f. Full direct digital control.
   g. Trend logging.
   h. Global communications.

F. Global Communications:
1. Broadcast point data onto network, making that information available to all other system control units.
2. Transmit any or all input/output points onto network for use by other control units and utilize data from other control units.

G. Input/Output Capability:
1. Discrete/digital input (contact status) isolated, either N.O. or N.C. as specified.
2. Discrete/digital output: Isolated relay contacts rated for 1 amp at 24 VAC, minimum.
3. Analog input: Compatible with sensors specified in Instruments and Control Elements..
4. Analog Output: Supervised Analog output compatible with operator(0-10VDC, 4-20mA, 3-15 PSI) with built-in HOA and manual positioner, 8 bit minimum.

5. Pulse input (5 pulses/second).
6. Pulse output (0-655 seconds in duration with 0.01 second resolution).

H. Provide transient protection on all I/O signals where cable or device is external to building.

I. Monitor, control, or address data points. Mix shall include analog inputs, analog outputs, pulse inputs, pulse outputs and discrete inputs/outputs, as required. Install control unit's with minimum 10 percent spare capacity.

J. Point Scanning: Set scan or execution speed of each point to operator selected time from 1 to 250 seconds.

K. Upload/Download Capability: Download from or upload to operator station. Upload/Download time for entire control unit database maximum 10 seconds on hard wired LAN, or 60 seconds over voice grade phone lines.

L. Test Mode Operation: Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:
1. Inhibit scanning and calculation of input points. Issue manual control to input points (set analog or digital input point to operator determined test value) from work station.
2. Control output points but change only data base state or value; leave external field hardware unchanged.
3. Enable control actions on output points but change only data base state or value.

M. Local display and adjustment panel: Integral to control unit, containing digital display, and numerical keyboard. Display and adjust:
1. Input/output point information and status.
2. Controller set points.
3. Controller tuning constants.
4. Program execution times.
5. High and low limit values.
6. Limit differential.
7. Set/display date and time.
8. Control outputs connected to the network.
9. Automatic control outputs.
10. Perform control unit diagnostic testing.
11. Points in "Test" mode.

2.4 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units and operator station(s) over local area network (LAN).

B. LAN Capacity: Not less than 60 stations or nodes.

C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

D. LAN Data Speed: Minimum 2500 Kb.

E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

F. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.

G. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.5 OPERATING SYSTEM SOFTWARE

A. Input/Output Capability From Operator Station:
   1. Request display of current values or status in tabular or graphic format.
   2. Command selected equipment to specified state.
   3. Initiate logs and reports.
   4. Change analog limits.
   5. Add, delete, or change points within each control unit or application routine.
   6. Change point input/output descriptors, status, alarm descriptors, and engineering unit descriptors.
   7. Add new control units to system.
   8. Modify and set up maintenance scheduling parameters.
   9. Develop, modify, delete or display full range of color graphic displays.
   10. Automatically archive select data even when running third party software.
   11. Provide capability to sort and extract data from archived files and to generate custom reports.
   12. Support two printer operations.
      a. Alarm printer: Print alarms, operator acknowledgments, action messages, system alarms, operator sign-on and sign-off.
      b. Data printer: Print reports, page prints, and data base prints.

B. Operator System Access: Via software password with minimum 30 access levels at work station and minimum 3 access levels at each control unit.

C. Web Based Operator System Access: Via software password with minimum 30 access levels at work station and minimum 3 access levels at each control unit.

D. Data Base Creation and Support: Changes shall utilize standard procedures. Control unit shall automatically check work station data base files upon connection and verify data base match. Minimum capability shall include:
   1. Add and delete points.
   2. Modify any point parameter.
   3. Change, add, or delete English language descriptors.
   4. Add, modify, or delete alarm limits.
   5. Add, modify, or delete points in start/stop programs, trend logs, etc.
   6. Create custom relationship between points.
   7. Create or modify DDC loops and parameters.
   8. Create or modify override parameters.
   9. Add, modify, and delete any applications program.
   10. Add, delete, develop, or modify dynamic color graphic displays.

E. Dynamic Color Graphic Displays:
   1. Utilizes custom symbols or system supported library of symbols.
   2. Sixteen (16) colors, minimum.
   3. Sixty (60) outputs of real time, live dynamic data per graphic.
   4. Dynamic graphic data.
   5. 1,000 separate graphic pages, minimum.
   6. Modify graphic screen refresh rate between 1 and 60 seconds.

F. Operator Station:
   1. Accept data from LAN as needed without scanning entire network for updated point data.
   2. Interrogate LAN for updated point data when requested.
   3. Allow operator command of devices.
   4. Allow operator to place specific control units in or out of service.
   5. Allow parameter editing of control units.

6. Store duplicate data base for every control unit and allow down loading while system is on line.
7. Control or modify specific programs.
8. Develop, store and modify dynamic color graphics.
9. Provide data archiving of assigned points and support overlay graphing of this data utilizing up to four (4) variables.

G. Alarm Processing:
1. Off normal condition: Cause alarm and appropriate message, including time, system, point descriptor, and alarm condition. Select alarm state/value and which alarms shall cause automatic dial-out.
2. Critical alarm or change-of-state: Display message, stored on disk for review and sort, or print.
3. Print on line changeable message, up to 60 characters in length, for each alarm point specified.
4. Display alarm reports on video. Display multiple alarms in order of occurrence.
5. Define time delay for equipment start-up or shutdown.
6. Allow unique routing of specific alarms.
7. Operator specifies if alarm requires acknowledgments.
8. Continue to indicate unacknowledged alarms after return to normal.
9. Alarm notification:
   a. Automatic print.
   b. Display indicating alarm condition.
   c. Selectable audible alarm indication.

H. Event Processing: Automatically initiate commands, user defined messages, take specific control actions or change control strategy and application programs resulting from event condition. Event condition may be value crossing operator defined limit, change-of-state, specified state, or alarm occurrence or return to normal.

I. Automatic Restart: Automatically restart field equipment on restoration of power. Provide time delay between individual equipment restart and time of day start/stop.

J. Messages:
1. Automatically display or print user-defined message subsequent to occurrence of selected events.
2. Compose, change, or delete any message.
3. Display or log any message at any time.
4. Assign any message to any event.

K. Reports:
1. Manually requested with time and date.
2. Long term data archiving to hard disk.
3. Automatic directives to download to transportable media such as floppy diskettes for storage.
4. Data selection methods to include data base search and manipulation.
5. Data extraction with mathematical manipulation.
6. Data reports shall allow development of XY curve plotting, tabular reports (both statistical and summary), and multi-point timed based plots with not less than four (4) variables displayed.
7. Generating reports either normally at operator direction, or automatically under work station direction.
8. Reports may either manually displayed or printed, or may be printed automatically on daily, weekly, monthly, yearly or scheduled basis.
9. Include capability for statistical data manipulation and extraction.
10. Provide capability to generate four types of reports: Statistical detail reports, summary reports, trend graphic plots, x-y graphic plots.

L. Parameter Save/Restore: Store most current operating system, parameter changes, and modifications on disk or diskette.

M. Data Collection:
1. Automatically collect and store in disk files.
2. Daily billable electrical energy consumption and time for up to 1024 zones over a 10 year period.
3. Provide archiving of stored data for use with system supplied custom reports.

N. Graphic Display: Support graphic development on work station with software features:
1. Page linking.
2. Generate, store, and retrieve library symbols.
3. Single or double height characters.
4. Sixty (60) dynamic points of data per graphic page.
5. Pixel level resolution.
6. Animated graphics for discrete points.
7. Analog bar graphs.
8. Display real time value of each input or output line diagram fashion.

O. Maintenance Management:
1. Run time monitoring, per point.
2. Maintenance scheduling targets with automatic annunciation, scheduling and shutdown.
3. Equipment safety targets.
4. Target point reset, per point.

P. Advisories:
1. Summary which contains status of points in locked out condition.
2. Continuous operational or not operational report of interrogation of system hardware and programmable control units for failure.
3. Report of power failure detection, time and date.
4. Report of communication failure with operator device, field interface unit, point, programmable control unit.

2.6 LOAD CONTROL PROGRAMS

A. General: Support inch-pounds and SI (metric) units of measurement.

B. Automatic Time Scheduling:
1. Self-contained programs for automatic start/stop/scheduling of building loads.
2. Support up to seven (7) normal day schedules, seven (7) "special day" schedules and two (2) temporary day schedules.
3. Special days schedule shall support up to 30 unique date/duration combinations.
4. Any number of loads assigned to any time program; each load can have individual time program.
5. Each load assigned at least 16 control actions per day with 1 minute resolution.
6. Sequence starting of equipment with motors 3 KW or larger with adjustable time delay.
7. Minimum of 30 holiday periods up to 100 days in length may be specified for the year.
8. Create temporary schedules.
9. Broadcast temporary "special day" date and duration.

C. Start/Stop Time Optimization:
1. Perform optimized start/stop as function of outside conditions, inside conditions, or both.
2. Adaptive and self-tuning, adjusting to changing conditions unattended.
3. For each point under control, establish occupancy period, desired temperature at beginning and end of occupancy period and modify start/stop times, operation of ventilation dampers & toilet exhaust fans.

D. Night Setback/Setup Program: Reduce heating space temperature setpoint or raise cooling space temperature setpoint during unoccupied hours; in conjunction with scheduled start/stop and optimum start/stop programs.

E. Calculated Points: Define calculations and totalization computed from monitored points (analog/digital points), constants, or other calculated points.
   1. Employ arithmetic, algebraic, Boolean, and special function operations.
   2. Treat calculated values like any other analog value, use for any function that a "hard wired point" might be used.

F. Event Initiated Programming: Event may be initiated by any data point, causing series of controls in a sequence.
   1. Define time interval between each control action between 0 to 3600 seconds.
   2. Output may be analog value.
   3. Provide for "skip" logic.
   4. Verify completion of one action before proceeding to next. If not verified, program shall be able to skip to next action.

G. Direct Digital Control: Each control unit shall provide Direct Digital Control software so that the operator may customize control strategies and sequences of operation by defining the appropriate control loop algorithms and choosing the optimum loop parameters.
   1. Control loops: Defined using "modules" that are analogous to standard control devices.
   2. Output: Paired or individual digital outputs for pulse-width modulation, and analog outputs, as required.
   3. Firmware:
      a. PID with analog or pulse-width modulation output.
      b. Floating control with pulse-width modulated outputs.
      c. Two-position control.
      d. Primary and secondary reset schedule selector.
      e. Hi/Lo signal selector.
      f. Single pole double throw relay.
      g. Single pole double throw time delay relay with delay before break, delay before make and interval time capabilities.
   4. Direct Digital Control loops: Downloaded upon creation or on operator request. On sensor failure, program shall execute user defined failsafe output.
   5. Display: Value or state of each of the lines which interconnect DDC modules.

H. Fine Tuning Direct Digital Control PID or floating loops:
   1. Display information:
      a. Control loop being tuned
      b. Input (process) variable
      c. Output (control) variable
      d. Setpoint of loop
      e. Proportional band
      f. Integral (reset) Interval
      g. Derivative (rate) Interval
   2. Display format: Graphic, with automatic scaling; with input and output variable superimposed on graph of "time" vs "variable".

I. Trend logging:
   1. Each control unit will store samples of control unit's data points.
   2. Update file continuously at discretely assignable intervals.
   3. Automatically initiate upload request and then store data on hard disk.
   4. Time synchronize sampling at operator specified times and intervals with sample resolution of one minute.
   5. Co-ordinate sampling with on/off state of specified point.

6. Display trend samples on work station in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time vs data.

2.7 HVAC CONTROL PROGRAMS

A. General:
1. Support Inch-pounds and SI (metric) units of measurement.
2. Identify each HVAC Control system.

B. Optimal Run Time:
1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.
2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.
3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
4. Use outside air temperature to determine early shut down with ventilation override.

C. Enthalpy Switchover:
1. Calculate outside and return air enthalpy using measured temperature and relative humidity; determine energy expended and control outside and return air dampers.

2.8 PROGRAMMING APPLICATION FEATURES

A. Trend Point:
1. Sample up to 6 points, real or computed, with each point capable of collecting samples at intervals specified in minutes, hours, days, or month.
2. Output trend logs as line graphs or bar graphs. Output graphic on terminal, with each point for line and bar graphs designated with a unique pattern, vertical scale either actual values or percent of range, and horizontal scale time base. Print trend logs up to 12 columns of one point/column.

B. Alarm Messages:
1. Allow definition of minimum of 50 messages, each having minimum length of 180 characters for each individual message.
2. Assign alarm messages to system messages including point's alarm condition, point's off-normal condition, totalized point's warning limit, hardware elements advisories.
3. Output assigned alarm with "message requiring acknowledgments".
4. Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.

C. Weekly Scheduling:
1. Automatically initiate equipment or system commands, based on preselected time schedule for points specified.
2. Provide program times for each day of week, per point, with one minute resolution.
3. Automatically generate alarm output for points not responding to command.
4. Provide for holidays, minimum of 100 consecutive holidays.
5. Output summary: Listing of programmed function points, associated program times, and respective day of week programmed points by software groups or time of day.

D. Interlocking:
1. Permit events to occur, based on changing condition of one or more associated master points.
2. Binary contact, high/low limit of analog point or computed point shall be capable of being utilized as master. Same master may monitor or command multiple slaves.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station.

C. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.2 PROGRAMING

A. Include operating system programming of software capability specified to provide:
   1. Set-up of system I/O capability, operator access as defined by the User, database creation and support.
   2. Graphic Display-Systems:
      a. Provide and generate dynamic color graphics providing menu-generated flow charting of each building process using background graphics, standard and user defined symbols and dynamic variables.
      b. Provide flow charting for each system indicating all available points.
      c. Indicate setpoint condition status by changing color, flashing. Provide flow charting for each system indicating all available points.
   3. Graphic Displays- Floor Plans:
      a. Provide building floor plan graphics with thermographics or temperature readouts and a change in color during alarms.
      b. Show actual locations of equipment, and thermostats on the graphics.
   4. Equipment Runtime monitoring.

B. Include Load Control and HVAC programming of software to provide:
   1. System and equipment operating to specified Sequence of Operation:
   2. Start-stop Optimization.
   3. Night set-up/set-back of temperature set-points as directed by User.

C. Include Application system programming of software capability specified to provide:
   1. Trend logging:
      a. Logging, reporting and graphing of user defined system trends on disk file and printer as directed by user.
      b. Organize data in each trend logs to facilitate documenting system operation in compliance with Sequence of Operation.
   2. Alarms: Logging, reporting and printing of user defined system alarms on disk file and printer as directed by user.
   3. Scheduling:
      a. Program user defined system scheduling of occupied times as directed by user.
      b. Implement optimized starting and stopping for building warm-up/cool-down before occupancy.
      c. Program user defined system scheduling as directed by user.

3.3 INSTALLATION

A. Install control units and other hardware in position on permanent walls where accessible for inspection, maintenance and repair and not subject to excessive vibration.

B. Identification:
   1. Nameplates: Identify all sensors mounted in mechanical rooms using device ID and number from control drawings with permanent label mounted adjacent to device. Nameplates shall be engraved plastic laminate with uppercase black letters on a white field, 1/4 inch minimum height.
      a. Mounting: Attach nameplates with epoxy cement or non-ferrous screws after final painting.
   2. Conduit/Cable Markers:

a. Color coded, sunlight resistant cable ties.
b. Location: Install on all conduit and raceways exposed or above ceilings in a visible location at:
   1) Connections to junction, pull boxes, or manholes. Label box cover with nominal system voltage, circuit number and panel identification legibly written with permanent marker.
   2) Connections to equipment.
   3) Each side of a wall, roof or floor penetration.
   4) Along straight runs at 50 feet intervals.
   5) At changes of direction.
   6) Parallel Conduits: Group markers on each conduit in-line with the adjacent marker.
c. Color: Baby Blue.

3. Color code cable with both ends identified with manufactured alpha-numeric self-adhesive vinyl tags, 3 mils thick, minimum, keyed to termination points.

C. Electrical wiring:
1. No splices between control panels are permitted.
2. All terminations of field wiring shall be to terminal strips.
3. Power wiring to control units shown on drawings is provided under Division 16. Provide conduit and conductors and power supplies and transformers to extend power to all supplemental control units.
4. Analog input and output cable shall be shielded with panel connection grounded to comply with Part 15, Sub-part J of FCC Rules and Regulations.
5. All Wiring materials and methods shall comply with Division 16 except:
   a. Minimum wire size shall be 18 AWG(copper).
   b. Conduit for concealed low voltage wiring above accessible ceilings may be omitted and plenum rated cable substituted.

3.4 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

3.5 DEMONSTRATION, TRAINING AND INSTRUCTIONS

A. Refer to Section 23 0510- Demonstration, Training and Instructions for additional requirements.

B. Demonstrate a complete and operating system to the Owner.

C. Provide services of control contractor's qualified technical personnel to instruct the Using agencies personnel in operation and maintenance of the control system. Instruction shall be in classroom setting at the project site.

END OF SECTION

SECTION 23 0994

HVAC SEQUENCE OF OPERATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Listing of required monitor points.

B. Sequence of operation for:
   1. Air Handling Units.
   2. Outside Air Pretreatment System.
   3. Fan Interlocks.
   4. Elevator machine rooms.
   5. Terminal air units.
   6. Unit heaters.

1.2 RELATED SECTIONS

A. Section 23 0923 - Digital Control Equipment.

B. Section 23 0913 - Instruments and Control Elements.

1.3 SYSTEM DESCRIPTION

A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections.

1.4 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements for submittal procedures.

B. Submit programming and proposed alarm messages with priority to RSA GMH FM/BAS for review.

C. Shop Drawings: Indicate mechanical system controlled and control system components.
   1. Label with settings, adjustable range of control and limits.
   2. Include written description of control sequence.
   3. Include flow diagrams for each control system, graphically depicting control logic.

D. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. All operators shall be in NORMAL position when each system is OFF.

B. Provide smoke detector in supply air stream on all air systems over 2000 CFM. Refer to NFPA 90A , 2002.

C. All temperatures are Fahrenheit.

3.2 MONITOR POINTS

A. Arrangement: Locate all control points for a system within one DDC panel within the mechanical equipment room containing the majority of the equipment for that system.

B. Monitoring: In addition to the temperature, pressure, digital or flow sensor points required to implement the sequence of operation, the points provided shall include as a minimum:

C. Temperatures:
   1. Outside air.
   2. Return air.
   3. Mixed air.
   4. Cooling coil discharge.
   5. Supply air.
   6. Chilled supply and return (each chiller).
   7. Domestic hot water tank.

D. Humidity:
   1. Space Relative .
   2. Return Air Relative.

E. Pressures:
   1. VAV duct static (analog).

F. Flow:
   1. Chilled water flow transducer.

G. Digital Inputs - Current Relay at Starters:
   1. Fan Status:EF-3,4,9,10,11
   2. Pump:CP-1,2
   3. Blower Coil: BC-1

H. Variable Frequency Drive(s); Drive Status
   1. Status - Ready
   2. Status - Run
   3. Status - Fault
   4. Drive - Frequency
   5. Drive - Current

I. Chiller(s)
   1. Leaving Water Temperature Reset
   2. Operating Status
   3. Current Limit Reset
   4. Safety Shutdown Status

J. Provide one spare input and output, digital and analog points for mechanical room.

3.3 AIR HANDLING UNIT

A. Supply Fan Start-Stop:
   1. A normally open digital output relay on time of day programming commands the variable frequency speed controller.
   2. Vary the unit start and stop times so that space temperatures are within setpoint for varying outdoor conditions using start/stop optimization software. Refer to 23 0923 .2.5.C
   3. The minimum OA damper is opened at the occupied time.
   4. The digital output relay stops the fan.
   5. TU digital thermostats un-occupied high and low limits shall start unit fan when any space temperature exceeds 85 degrees or is 50 degrees or lower during un-occupied times.

B. Supply Fan Start-Stop:
   1. DDC time of day programming, normally open, opens smoke damper and end switch starts fan. Stops fan and closes damper],
   2. DDC time of day programming, normally closed contact opens outside air damper (OAD) and end switch starts fan. Stops fan and closes damper.

3. Time Clock.
4. Interval timer.
5. Nite thermostat set at 65 .
6. DDC nite low limit set at 65 .
7. DDC zone low limit set at 65 .
8. Provide optimum start programming to vary the system start time based on outside air temperature and historic time needed to reach setpoint from that temperature.

C. Safety Controls to Stop Supply Fan:
1. Low limit thermostat(s) in air entering chilled water coil (hardwire). Provide manual reset switch and "Freezestat Tripped" indicator light in face of control panel.
2. Firestat in R.A. duct.
3. Normally closed fire alarm output relay (hardwire).
4. Hardwired high limit static pressure sensor in the supply duct(4.0 inch setpoint).
5. Emergency fan shutdown switch located adjacent to apparatus casing door.

D. Safety Controls to Stop Supply Fan:
1. Low limit thermostat(s) in air entering chilled water coil (hardwire). Provide manual reset switch and "Freezestat Tripped" indicator light in face of control panel.
2. Firestat in R.A. duct.
3. Smoke detector in supply air duct.
4. Normally closed fire alarm output relay (hardwire).
5. Hardwired high limit static pressure sensor in the supply duct(4.0 inch setpoint).

E. Supply Fan Capacity Control:
1. A variable frequency speed controller modulates fan speed to maintain the damper on the most open TU/PIU air terminal unit as follows:
   a. Upon start-up, the initial duct static pressure control point shall be 1.25" w.g. After a preset stabilization interval (20 minutes);
   b. If the most open air terminal damper is greater than 95% open, increase the static setpoint by 0.15 w.g. (adjustable). Increment this sequence until the most open air terminal damper is between 85-95% open.
   c. If the most open damper position is between 85-95%, hold the setpoint.
   d. If the most open air terminal damper is less than 85% open, lower the static setpoint by 0.1" w.g. (adjsutable).
   e. Poll the Air Terminal Units at a 10 minute interval (adjustable).
   f. Provide a static pressure sensor in the S.A. duct where shown to monitor duct pressure.
   g. Establish maximum and minimum static pressure limits int he program during Test & Balance.
2. Provide interface to variable speed drive to monitor amperage, drive output frequency, ON-OFF status, drive alarm status. Display these on air handler graphics screen.

F. Minimum OA Dampers:
1. The normally closed minimum OA damper shall open when air unit SA fan is on and the time of day indicates the building is occupied or if any monitored exhaust fans are on.

G. Minimum Outside Air(OA) Damper(s): N.C.; Open when air unit S.A. fan is ON and digital time of day program indicates space is occupied.

H. Maximum OA/RA/Relief Dampers: N.C./N.O./N.C.; modulate to maintain space temperature, at 60 ODT and below; minimum S.A. temperature 50 ; NORMAL when minimum O.A. damper is closed.

I. D.B. Economizer Cut-in: Actuates O.A./R.A./EA dampers to O.A. for economy cooling whenever system is on and outside air is below [60 F].

J. Chilled Water Coil: 3-way valve, N.O. to coil, modulates water flow to maintain cold deck temperature at 55 F.

K. AHU Heating Coil: SCR controller modulates coil to maintain 55F discharge temperature.

L. Morning Warmup (VAV-DDC): When air handling unit supply fan is running, O.A. dampers remain shut and exhaust fan(s) interlocked with unit shall remain OFF, until occupancy, terminal air valves remain in full open position, fan powered induction unit air valves operate normally, and preheat SCR valve modulates to maintain 75 F supply air temperature.

M. Control Panel ACP-: Mount in mechanical room with the following items in the cover:
   1. ON indicator lights:
      a. Low Temperature Detector.
   2. System OFF-ON switch.

3.4 MISCELLANEOUS FAN SEQUENCES

A. General: Where exhaust fans are indicated to be interlocked with air handling equipment, fans shall be interlocked with minimum outside air dampers for indicated equipment, unless otherwise noted.

B. EF-1, EF-1A (existing), EF-1B(existing): Provide lighted wall mounted switch for each fan. Interlock fans with associated automatic volume dampers as indicated on drawings.

C. EF- 4 & 5: Provide lighted wall mounted switch for each fan, interlock fans to command associated room TU/FP boxes closed upon activation of either associated fan. Interlock fans with associated automatic volume dampers as indicated on drawings.

D. Carbon Monoxide fan (EF-8): wall mounted combination starter/disconnect. Interlock with associated automatic volume dampers as indicated on drawings.

E. Toilet fans: ON.

F. Cosmetology fan (EF-11): Variable frequency drive shall modulate fan speed to maintain airflow from Minimum 2730cfm to Maximum scheduled flow rate based on occupancy schedule to maintain negative pressurization of cosmetology area.

G. Mechanical Room ventilation fan (EF-12): Wall mounted electric thermostat cycles fan thru starter to maintain setpoint.

H. EF-2,3,7,&13: Wall mounted electric thermostat cycles fan thru starter to maintain setpoint.

I. EF-6: Interlock with AHU-1.

J. EF-11,14,&15: Interlock with AHU-2.

3.5 AIR TERMINAL UNITS

A. Terminal Units with Heating Coil(Dual Minimum-Variable Heating Minimum):
   1. Cooling: A room digital thermostat thru terminal unit controller modulates the variable air volume damper from the maximum to the cooling minimum CFM setpoint to maintain the 75 Degree F cooling setpoint.
   2. Set the cooling minimum at 0 CFM unless noted otherwise.
   3. Heating: The room digital thermostat thru terminal unit controller modulates the variable air volume damper from the heating minimum to the heating maximum CFM setpoints through SCR controller to maintain the 70 degree heating setpoint.
   4. Cooling-Heating change-over; Use the room temperature and the demand for heating or cooling to switch unit control from cooling to heating and back.

B. Fan Powered Series Induction Boxes:

1. Unit fans run when respective unit supply fan is ON or by unoccupied low or high limit. Provide fan start sequence so that box fans on series boxes are operating before system supply fan starts.
2. Room digital thermostat thru terminal controller modulates N.C. damper actuator and SCR controlled electric heater thru specified stages in sequence to maintain setpoint temperature.
3. Deadband control strategy is not acceptable. Unit shall have (1) setpoint and control with full cooling at 2-degrees above setpoint and full heating at 2-degrees below setpoint.
4. Electrical/Plumbing Lab: Air to zero if EF-4 or 5 is ON.

C. Blower Coil Units: N.O. three-way cooling coil valve shall modulate in sequence on control of wall mounted digital thermostat thru terminal control unit(TCU) to maintain space temperature. OFF if EF- 8, 9, or 10 is ON.

3.6 HEATING TERMINAL UNITS

A. Electric Cabinet Heater: Single temperature room thermostat set at 68 degrees F maintains constant space temperature by cycling unit fan motor and electric heating elements. Integral thermostat continues fan operation until element temperature falls below 100 degrees F .

B. Electric Draft Barrier: Single temperature room thermostat set at 68 degrees F maintains constant space temperature.

C. Electric Unit Heater: Single temperature room thermostat set at 68 degrees F maintains constant space temperature by cycling unit fan motor and energizing electric heat coil. Integral thermostat continues fan operation until element temperature falls below 100 degrees F .

3.7 CENTRAL CHILLED WATER SYSTEMS

A. Lead Pump CP: ON when systems are on in call for cooling.

B. Lag Pump CP: ON when lead pump drive fails.

C. Chiller Pump Sequencing: Provide adaptive software to manage chiller pump line to sequence pumps, managing rotation to optimize efficiency for load profile, equalize run-time and react to equipment malfunctions.

D. Time of Day Programming shall be coordinated such that air handlers are staged off at 5 minute intervals before chiller is stopped.

E. Air Cooled Chiller: Operates on built-in chiller controls when chilled water pump is operating , through the starter interlock and DP switch at the chiller. Provide remote reset of the chiller leaving water temperature.

F. Energize chilled water pump to start and allow the chiller to start on a call for cooling.

G. When chilled water pump starts, open chiller control valve.

H. Modulate the chiller control valve to maintain constant flow through the chiller.

I. When the chilled water flow is proven by flow switches, allow the refrigeration machine to start.

J. Display:
1. System Graphic
2. Chiller water pump on/off switch
3. Chiller on/off indication
4. Chiller condensing water supply and return temperature
5. Chilled water supply and return temperature
6. Chilled water control point adjustment
7. Chilled water pump on/off/auto switch
8. Chiller on/off switch

3.8 ELEVATOR MACHINE ROOMS

A. On room temperatures above 90 degrees F, signal alarm.

END OF SECTION

SECTION 23 2113

HYDRONIC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe and pipe fittings for:
   1. Chilled water piping system.

B. Valves:
   1. Gate valves.
   2. Ball valves.
   3. Butterfly valves.
   4. Check valves.
   5. Flow Indicator Balancers.

1.2 RELATED REQUIREMENTS

A. Section 23 0510 - General Mechanical Requirements- Pipe sleeves.

B. Section 23 0516 - Expansion Fittings and Loops for HVAC Piping.

C. Section 23 0553 - Identification for HVAC Piping and Equipment.

D. Section 23 0719 - HVAC Piping Insulation.

E. Section 23 2114 - Hydronic Specialties.

F. Section 23 2500 - HVAC Water Treatment: Pipe cleaning.

1.3 REFERENCE STANDARDS

A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2007.

B. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

C. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2004 (ANSI/ASME B31.9).

D. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2007.

E. ASTM A 234/A 234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2007.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2006 and Errata.

1.4 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide non-conducting dielectric connections whenever jointing dissimilar metals.

C. Fittings: Mitered Fittings and tapped pipes are not allowed. Weld elbows shall be long radius unless otherwise noted.

D. Weldolets and Threadolets in Steel Piping: Weldolets and threadolets may be used for side outlet reducing tees if more than two pipe sizes smaller than main. Bonney Forge or Allied type 1 branchlet.

E. Provide pipe hangers and supports in accordance with ASME B31.9 unless indicated otherwise.

F. Support piping independently from equipment.

G. Provide gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

H. Provide valves for shut-off and to isolate equipment, part of systems, or vertical risers.

I. Provide ball or butterfly valves for throttling or manual flow control service.

J. Provide check valves on discharge of all pumps.

K. Butterfly valves used to isolate equipment or to isolate lines where flanges will be removed shall be lug end.

L. Install all 5 inch and larger manually operated gate valves in mechanical rooms located seven feet or more above the floor with their spindles horizontal and fitted with chain wheels.

M. Drains: Provide 3/4 inch gate valves with gasketed cap with chain for drains at main shut off valves, low points of piping, bases of vertical risers, and at equipment.

N. Air Vents: Provide manual or automatic air vents in accordance with Section 23 2114 at all high points in the piping and where shown.

1.5 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

C. Welders Certificate: Include welders certification of compliance with ASME (BPV IX).

D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum five years of experience.

B. Welder Qualifications: Certify in accordance with ASME (BPV IX).

1.7 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 code for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage and store in a protected location.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 CHILLED WATER PIPING, ABOVE GROUND

A. Steel Pipe: ASTM A 53/A 53M, Schedule 40, black.
   1. Fittings: ASME B16.3, malleable iron or ASTM A 234/A 234M, wrought steel welding type.
   2. Joints:
      a. Pipe sizes 2 inch and smaller: Threaded.
      b. Pipe sizes 2-1/2 inch & larger and all concealed above non-accessible ceilings: AWS D1.1,welded.
      c. Pipe sizes 2-1/2 inch & larger in mechanical rooms and other non-concealed locations may be grooved couplings at the Contractor's option.

2.2 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A 53/A 53M, Schedule 40 galvanized.
   1. Fittings: Galvanized cast iron, or ASME B16.3 malleable iron.
   2. Joints: Threaded.

2.3 PIPE HANGERS AND SUPPORTS

A. Manufacturers: B-Line, Grinnell, Globe or Michigan. Figure numbers are for Michigan.

B. Conform to ASME B31.9.

C. Hangers Sizes 1/2 to 3/4 Inch: Carbon steel, adjustable swivel, loop. Figure 100.

D. Hangers Sized for Cold Pipe 1 Inch and Over: Carbon steel, adjustable, clevis. Figure 400.

E. Multiple or Trapeze Hangers(Up to 2 inch pipe size): Green epoxy coated, cold formed, lipped steel channels, sized for pipe load and span, 1-5/8" x 1-5/8" x 12 gauge minimum, with pipe/tubing clamps, elastomer cushion, spring held, hardened steel nuts and hanger rods.

F. Multiple or Trapeze Hangers(Over 2 inch pipe size): Steel channels with welded spacers and hanger rods.

G. Wall Support for Single Pipe Sizes to 3 Inches: Carbon steel extension split ring pipe clamp, Figure 455.

H. Wall Support for Vertical Multiple Pipes(1-1/2 inch and under: Green epoxy coated, cold formed, lipped steel channel horizontal member, 1-5/8" x 1-5/8" x 12 gauge base. Secure pipes to base with pipe/tubing clamps and elastomer cushion.

I. Wall Support for Pipe Sizes 4 Inches and Over: Heavy duty, Welded carbon steel bracket and wrought steel clamp, Figure 353.

J. Vertical Support: Steel riser clamp, Figure 510.

K. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.4 UNIONS, FLANGES, AND COUPLINGS

A. Unions for Pipe 2 Inches and Under:
   1. Ferrous Piping: 150 psig malleable iron, threaded.
   2. Copper Pipe: 400 psig WOG @ 275 degrees F, Brass O-Ring type with EPDM O-Ring , brass nut and tailpiece. Threaded or soldered with reduced size end connection as required by component connection. Apollo UA, FDI UP
   3. Test Plug tappings may be included on union tailpieces to provide the test plugs specified at piping components.

B. Flanges for Pipe Over 2 Inches:
   1. Ferrous Piping: 150 psig forged steel, slip-on, unless noted otherwise.
   2. Copper Piping: Bronze.
   3. Gaskets: 1/16 inch thick preformed neoprene.

C. Grooved and Shouldered Pipe End Couplings for pipe over 2 inches:
   1. Housing Clamps: ASTM A-47-77 Malleable or ASTM A-536-77 ductile iron to engage and lock, rigid clamp. Provide flexible housing designed to permit some angular deflection, contraction, and expansion in locations indicated under installation. Gruvlok 7000, Victaulic 07, Ward 3400.
   2. Sealing Gasket: C-shape elastomer of ASTM D-2000-80 chlorinated butyl grade 'H' composition for operating temperature range from -30 degrees F to 230 degrees F.
   3. Accessories: ASTM A183-63 heat treated carbon steel bolts, nuts, and washers.

D. Dielectric Connections: Dielectric nipple with galvanized or plated steel threaded ends. FDI-DN, Perfection.

2.5 GATE VALVES

A. Up To and Including 2 Inches:
   1. Manufacturers: Crane Model 438, Grinnell 3000, Hammond IB 645, Kitz 40, Milwaukee 105, Nibco T113, Stockham B103, Watts B 3000.
   2. 200 psig WOG, bronze body, bronze trim, screwed bonnet, non-rising stem, cast or malleable iron handwheel, inside screw with backseating stem, solid wedge disc, alloy seat rings, threaded ends.

B. Over 2 Inches:
   1. Manufacturers: Crane Model 461, Grinnell 6060A, Hammond IR 1138HI, Kitz 75, Milwaukee F 2882-M, Nibco F619, Stockham G612, Watts F-502.
   2. 200 psig WOG, iron body, bronze trim, bolted bonnet, non-rising stem, cast or malleable iron handwheel, solid wedge disc with bronze seat rings, flanged ends.

2.6 BALL VALVES

A. Up To and Including 2 Inches:
   1. Two Piece Manufacturers: Apollo Model 70-100, Crane 9301, Flow Design HB/HC, Hammond 8201, Milwaukee BA200, Nibco T580, Stockham T255, Watts B6000.
   2. 400 psig WOG, Bronze two piece body, full port, chrome plated brass ball, reinforced teflon seats and stuffing box ring, blow-out proof stem design, adjustable packing gland, zinc coated steel lever handle with vinyl hand grip with memory stops on balance valves , threaded ends.

2.7 BUTTERFLY VALVES(Over 2 inches)

A. Manufacturers: Centerline Model 200, Crane 12, Grinnell 8000, Hammond 5111, Milwaukee WA, Mueller 66M, Nibco WD-2000-3, Stockham LG551.

B. Location: Use where specifically shown on Drawings, Detail or Flow Diagram. Refer to Legend for butterfly valve symbol.

C. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.

D. Disc: Aluminum bronze.

E. Operator: 10 position lever handle.

2.8 SPRING LOADED CHECK VALVES(Over 2 inch)

A. Manufacturers: Centerline Model CLC, Duo-Check G12HMP, Hammond IR9253, Marlin HZNSF, Metraflex 700, Milwaukee 1400, Muessco 91AP/92AP, Stockham WG970..

B. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

2.9 FLOW INDICATOR-BALANCERS

A. Manufacturers: B&G Circuit Setter, AAF #6000, Taco #790, Illinois #6000, Flow Set -F,HCi Terminator, Florater, Gerand, Armstrong "CBV", Wheatley "BV".

B. Balancer: Calibrated bronze screwed balance valve with indicating pointer, memory stop, and with pressure taps for connecting differential pressure meter. Pressure taps shall be equipped with caps and integral check valves. Each valve shall have preformed, removable insulation cover. Locate to provide unrestricted flow up and down-stream in accordance with manufacturer's recommendations.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. Refer to Section 23 2500 for additional requirements.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain plumb and level, unless noted otherwise.

C. Maintain 4 inch clearance between pipe and fittings after insulation.

D. Install piping to conserve building space and to avoid interfere with use of space.

E. Group piping at common elevations.

F. Sleeve pipe passing through new masonry partitions, walls and floors. Provide sleeves at rated partitions as required by firestopping assembly.

G. Maintain top of piping level with eccentric reducers. Arrange to drain at low points.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

I. Install valves and piping appurtenances in a readily accessible location.

J. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as scheduled.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 24 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

7. Use double nuts and lock washers on threaded rod supports.
8. Prime coat concealed steel hangers and supports not provided with a corrosion resistant finish. Refer to Section 09 9000.
9. Support piping from floor only where shown on drawings or where piping is routed along floor.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 0719.

L. Prepare exposed unfinished pipe, fittings, supports, and accessories, ready for finish painting.

M. Install valves and pipe appurtenances in a readily accessible location.

N. Install valves with stems upright or horizontal, not inverted.

O. Loop valve operator chains to within four (4) feet of the floor, and provide holding clips to secure the chains when not in use.

P. Unions: Provide unions at locations specified and at all locations to permit removal of equipment and ATC control valves for service. Install in correct direction with brass nut upstream. Do not install unions to expedite pipe assembly. Use flanges or grooved coupling for unions for pipes sizes over 2 inch.

Q. Dissimilar Metals (Dielectric): Provide dielectric nipples to provide separation between ferrous and nonferrous piping/fittings. Install on ferrous side of connection. Do not install dielectric unions. Dielectric connection shall be comprised of dielectric nipple or thread-to sweat brass adapter or brass valve. Install unions specified with dielectric nipple where separation is required at a union.

R. Steel Pipe Nipples:All thread(close) nipples are prohibited. Nipples 1-1/2 inch and smaller and attached to larger pipes shall be schedule 80 and attached by the use of threadolets.

3.3 SCHEDULES

A. Hanger spacing indicated is maximum span based on pipe material and size. Conform to structural spacing and load capacity of structural support points and provide closer spacing as required.

B. Hanger Spacing for Steel Piping.
1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
8. 6 inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.

END OF SECTION

SECTION 23 2114

HYDRONIC SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Expansion tanks.

B. Chilled water storage tanks

C. Make-up water station.

D. Air vents.

E. Air separators.

F. Pump suction diffuser fittings.

G. Relief valves.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping.

1.3 REFERENCE STANDARDS

A. ASSE 1013 - Reduced Pressure Principle Backflow Preventers; American Society of Sanitary Engineering; 1993.

1.4 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Provide Certificate of Shop Inspection for Chilled Water Storage Tanks.

E. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on specialties. Maintain in place until installation.

C. Protect from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 CHILLED WATER STORAGE TANKS

A. Construction: Closed, welded steel, tested and stamped in accordance with Section IV of the ASME Code, registered with the National Board of Boiler and Pressure Vessel Inspectors; cleaned, prime coated, and supplied with steel supports; with tappings for installation of accessories.
   1. Pressure rating: 100 psi.

2. Provide internal baffle 2/3 of tank height as shown on drawings.
3. Provide 3/4-inch air vent tapping at high point of tank.
4. Provide 1-inch drain tapping on side of tank at lowest point possible with pipe extension to clear tank.
5. Size as indicated on Drawings.

B. Opening shall be threaded for sizes under 3-inch. Openings shall be flanged for sizes 3-inch and over. Provide extension on all openings to extend through insulation thickness specified. Provide one opening high on one side of tank and one popening low on oposite side of tank as detailed.

C. Provide minimum 11 inch by 15 inch manhole per ASME on tanks above 400 gallon storage capacity.

D. Tanks shall be mounted vertically with a minumum of three steel legs with angle clips to secure tank to housekeeping pad and structure. Legs and clips shall be factory welded to form a factory finished assembly. Legs and clips shall be of sufficient height to allow insertion of 5-inch long anchor bolts.

E. Insulation: Provide factory insulation consisiting of 1-inch thick foam insualtion. Insualtion shall be preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 3. Provide white UV finish coating.

F. Manufacturers: Woods, Locjhinvar, Cemline.

2.2 EXPANSION TANKS

A. Manufacturers:
1. Amtrol AX or L Series.
2. Other acceptable manufacturers offering equivalent products.
   a. Armstrong AX or L Series.
   b. Bell & Gossett.
   c. Taco CA.
   d. Wheatley WA.
   e. Wessels NTA or NLAP

B. Construction-60 gallons and over: Welded steel, tested and stamped in accordance with ASME (BPV VIII, 1); supplied with National Board Form U-1, rated for working pressure of 125 psi, with replaceable, flexible butyl bladder, and steel support stand.

C. Tank shall be suspended horizontally from structure.

D. Accessories: Pressure gage and air-charging fitting, tank drain for replaceable diaphragm tanks; precharge to pressure indicated on Drawings.

E. Provide factory enamel finish on tanks.

2.3 MAKE-UP WATER STATION

A. Pressure reducing valve, backflow preventer, test cocks, strainer, Gauge, and valved by-pass, Refer to Detail on Drawings.

B. Pressure Reducing Valve: 300 PSIG maximum working pressure at 160 degrees F maximum operating temperature. Bronze pressure reducing valve for dead-end service with NPT union inlet and NPT female outlet for standard (25-75 PSIG) or low (10-35 PSIG) reduced pressure range as shown on drawings. Watts U5B.

C. Backflow Preventer: ASSE Std 1013, 175 PSIG maximum working pressure Bronze Reduced Pressure type with built-in air gap, air gap fitting, test cocks and isolation ball valves. Manufacturers: Watts 009, Conbraco Series 40-200, Febco Series 825Y, Hersey Series FRP-11, or Wilkins Series 975XLS

2.4 AIR VENTS

A. Manual Type:
   1. Pipe Sizes up to 2 inches: Short vertical sections of pipe to form air chamber, same size as pipe, with 1/2 inch brass ball or gate valve at top of chamber.
   2. Pipe Sizes 2-1/2 inches and over. Short vertical sections of 2-1/2 inch diameter pipe to form air chamber, with 1/2 inch brass ball or gate valve at top of chamber.
   3. Equipment Rooms: Terminate discharge along wall with valve and hose end connection in an accessible location. Refer to detail on drawings.

B. Automatic Float Type:
   1. Manufacturers: Amtrol 706, Armstrong 75, Hoffman 79, Wheatley 79, Watts 4VA.
   2. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2.5 AIR SEPARATORS

A. In-line Air Separator(Air Purger):
   1. Manufacturers:
      a. Amtrol Model .
      b. Armstrong International, Inc; Model ART: www.armstronginternational.com.
      c. ITT Bell & Gossett; Model AS: www.bellgossett.com.
      d. Woods Model .
   2. 2 inch and smaller, cast iron or steel; tested and stamped in accordance with ASME (BPV VIII, 1); for 125 psi operating pressure with threaded connections.
   3. 2-1/2 inch and larger; cast iron or steel, tested and stamped in accordance with ASME (BPV VIII, 1); for 125 psi operating pressure with flanged connections.

2.6 PUMP SUCTION DIFFUSER FITTINGS

A. Manufacturers:
   1. Armstrong SG.
   2. ITT Bell & Gossett; Model Z: www.bellgossett.com.
   3. Mueller 1011.
   4. Weatley SO.

B. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure and sized for pump and system connections, with stainless steel inlet vanes, stainless steel cylinder strainer arranged for horizontal removal, disposable fine mesh start-up strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

C. Cylinder strainer with 3/16 inch diameter openings for closed piping systems.

D. Cylinder strainer with 1/8 inch diameter openings for open piping systems.

E. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping in side.

2.7 RELIEF VALVES

A. Manufacturers:
   1. Watts Model 3L.
   2. Other acceptable manufacturers offering equivalent products:Armstrong, Bell & Gossett, Hoffman, Kunkle, Spence.

B. Bronze body, teflon seat, stainless steel stem and springs and test lever, automatic, direct pressure actuated, capacities ASME certified and labelled.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Install specialties in a readily accessible location.

C. Adjust pressure reducing valve for initial fill pressure indicated on Drawings.

D. Adjust diaphragm tank air pressure for initial fill pressure indicated on Drawings prior to filling system.

E. Provide manual air vents at system high points and as indicated.

F. Provide valved drain and hose connection on storage tanks..

G. Provide schedule 80 steel pipe legs with welded, 10 gauge, plate feet with minimum diameter twice that of the pipe legs required to insert into the factory couplings.

H. Remove temporary strainers after cleaning systems and approximately 60 hours operating time. Tie to pump fitting without cleaning for removal after observation.

I. Chilled water storage tanks:
   1. Shim tanks to be level.
   2. Secure to housekeeping pad and structure with a minimum of 3 each 5/8" diameter by 5 inch long anchor bolts.
   3. Provide ball valve and automatic air vent at high point of tank.
   4. Provide 1-inch gate valve at drain fitting on tank. Install a threaded brass plug into open end of valve.

J. Pipe relief valve outlet to floor. End of pipe or fitting shall not be threaded.

END OF SECTION

SECTION 23 2123

HYDRONIC PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Base mounted, end suction pumps.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

1.3 REFERENCE STANDARDS

A. UL 778 - Standard for Motor-Operated Water Pumps; Underwriters Laboratories Inc.; 2002.

1.4 PERFORMANCE REQUIREMENTS

A. All pumps shall operate at 1750 RPM unless noted otherwise.

B. Pump motors shall not overload at any point on the pump curve.

C. Impeller diameter shall not exceed 85% of casing accommodation as measured from pump cut water through centerline of shaft.

D. Pump characteristic curve shall rise continuously from maximum capacity to shut-off with shut-off head a minimum 10% greater than design head.

1.5 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Submit all items in the fluid stream with or prior to pump submittals.

C. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

E. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

1.7 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by UL 778 as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 BASE MOUNTED END SUCTION PUMPS (ES)

A. Manufacturers:
   1. Aurora Model 344A.
   2. Armstrong Model 4030.
   3. Bell and Gossett Model 1510.
   4. Paco Model LF.

5. Peerless Model F.

B. Type: Horizontal shaft, single stage, direct connected, radially split casing, for 125 psi maximum working pressure.

C. Casing: Casing shall be minimum Class 35 cast iron and provided with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug(s) at the low point(s), vent(s) at the high point(s), flanged suction and discharge.

D. Impeller: Impeller shall be centrifugal, fully enclosed, non-overloading, bronze and keyed to shaft with a guide ring and mechanical seal.

E. Bearings: Bearings shall be Grease lubricated roller or ball bearings.

F. Shaft: Shaft shall be SAE 1144 steel with a #304 stainless steel shaft sleeve.

G. Seal: Mechanical seal(s) shall be carbon rotating against a stationary ceramic seat, 225 degrees F maximum continuous operating temperature.

H. Coupling: Pump and motor shall be direct connected through Woods Standard Sureflex flexible coupling with coupling guard mounted on a common metal base.

I. Bases for pumps handling chilled water shall be provided with a stainless steel drain pan extending under the suction diffuser and 1/2-inch tapped drainage opening.

J. Motor: 1750 rpm unless specified otherwise; refer to Section 23 0513.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over. Refer to Section 23 0548.

D. Check, align, and certify alignment of base mounted pumps after pump leveling, after piping connections are made, and again after operation of the system for a three (3) week continuous period of time.

E. Install base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to Section 03 3000.

F. Lubricate pumps before start-up.

3.3 STARTING EQUIPMENT

A. Provide manufacturer's field representative to prepare and start equipment.

B. Adjust for proper operation within manufacturer's published tolerances.

C. Demonstrate proper operation of equipment to the Owner 's designated representative.

3.4 SCHEDULES

A. Refer to Pump Schedule on Drawings.

END OF SECTION

SECTION 23 2500

HVAC WATER TREATMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cleaning of piping systems.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping.

B. Section 23 2114 - Hydronic Specialties.

1.3 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

C. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.

D. Certificate: Provide Manufacturer's Certificate in accordance with Article E-67.

1.4 REGULATORY REQUIREMENTS

A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

B. Test equipment: Furnish basic water testing equipment to include case and spare reagents for maintaining control of the program standards in the closed loop systems. The test kit shall include reagents and apparatus for determination of corrosion inhibitor level in the loop. All test equipment shall be delivered to the HVAC Shop at start-up.

PART 2 PRODUCTS

2.1 MATERIALS

A. System Cleaner:
   1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.
   2. The cleaner shall contain an inorganic phosphate, an organic corrosion inhibitor, dispersant, and an oil emulsifier.

B. Closed System Treatment (Water):
   1. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
   2. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
   3. Conductivity enhancers; phosphates or phosphonates.

2.2 WATER METER

A. Manufacturers:
   1. Badger; Model ER.
   2. Hays; Model MT.
   3. Hersey; Model MHD.

B. Displacement type cold water meter with sealed, tamper-proof magnetic drive, impulse contact register, single pole, double throw dry contact switch.

2.3 AUTOMATIC FLOW CONTROL VALVE

A. Manufacturers: Autoflow, Flow Design, Griswold.

B. Construction: Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 12 times minimum pressure required for control, maximum minimum pressure 5 psi.

D. Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.

PART 3 EXECUTION

3.1 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning.

B. Place terminal control valves in open position during cleaning.

C. Verify that electric power is available and of the correct characteristics.

3.2 CLEANING SEQUENCE

A. Concentration:
   1. As recommended by manufacturer.

B. Chilled Water Systems:
   1. Circulate for 48 hours, then drain systems as quickly as possible.
   2. Refill with clean water, circulate for 24 hours, then drain.
   3. Refill with clean water and repeat until system cleaner is removed.

C. Remove, clean, and replace strainer screens.

D. Remove strainer start-up screens and leave at strainer until the completion of Project observations.

E. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

F. Inspect make-up water stations, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.4 CLOSED SYSTEM TREATMENT

A. Provide one bypass chemical feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

B. Introduce closed system treatment through bypass chemical feeder when required or indicated by test.

3.5 MANUFACTURERS FIELD SERVICES

A. Provide services of factory trained representative to inspect the piping installation and test the cleanliness of the project's piping systems and make-up water system before chemical treatment, Representative shall drain low points and check system strainers for cleanliness and ensure piping systems are clean and ready for chemical treatment.

B. Factory trained representative shall start-up and calibrate chemical feed controls provided under this Section.

C. Factory trained representative shall test each systems chemical treatment prior to the Observation for Substantial Completion.

D. Demonstrate system operation to the Owner and instruct the Owner in required maintenance.

E. Provide start-up certificate certifying that the piping systems have been cleaned and treated as specified.

END OF SECTION

SECTION 23 3100

HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.

B. Flexible Ducts.

1.2 REFERENCE STANDARDS

A. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2007.

B. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum five years of documented experience.

1.4 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

1.5 DELIVERY, STORAGE, AND PROTECTION

A. Store in clean dry place and protect from weather and construction traffic.

B. Exercise care during construction to prevent the accumulation of dust, dirt, and refuse in the supply and return ductwork.

C. All openings shall be tightly closed with 8-mil polyethylene when work creating dust and debris is in progress.

PART 2 PRODUCTS

2.1 MATERIALS

A. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M FS Type B, with G90/Z275 coating.

B. Insulated Flexible Ducts:
   1. Manufacturers:
      a. Atco Model UPC-037.
      b. Flexmaster Model Type 3M.
      c. Thermaflex Model M-KE.
   2. UL 181, Class 1, aluminum laminate and polyester film mechanically bonded without adhesive supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
      a. Insulation shall be 1 inch thick, minimum; 3/4 lbs/cu ft,minimum
      b. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
      c. Maximum Velocity: 4000 fpm.
      d. Temperature Range: -20 degrees F to 210 degrees F.

C. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.

2.2 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. All dimensions are net inside metal measurements in inches unless otherwise shown.

C. Duct sizes shown include allowance for liner thickness unless otherwise noted, except sizes shown for lined round spiral and flat oval duct are sizes of perforated inner liner

D. Longitudinal seams for Rectangular Duct: Fig 2-2 L-1(Pittsburgh) or L-2(button punch snap lock) for corner seams. Do not use L-2 seam for ducts over 18 inch. Seal L-2 seams with duct sealant. Fig 2-2 L-3 seam for seams other than corner.

E. Unreinforced Duct: Fabricate ducts in clearance critical areas such as chases and above ceilings to unreinforced standards and accordance with Fig 2-8.

F. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used , provide turning vanes in accordance with Figs 4-3 and 4-4. Provide single vanes for 18" width or less and double vane over 18 inch width or height. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

G. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used , provide turning vanes in accordance with Figs 4-3 and 4-4. Provide single vanes for 18 inch width or less and double vane over 18 inch width or height.

H. Exposed duct finish shall be mill phosphatized for field painting.

I. Supply branch connections:
   1. Rectangular Branch and Rectangular Diffuser Runouts: Fig 4-6, 45 degree entry with flange and gasket for connection to trunk with a minimum of six screws.
   2. Round Runouts from Rectangular ducts: Manufactured fitting with 45 degree entry, flanged & gasket for connection to trunk with a minimum of six screws. Provide volume control damper with locking quadrant at branch connection in Ductwork Pressure Class 2 inch or less, unless over inaccessible ceiling(Refer to Grille Schedule on Drawings).
   3. Round runouts from round ducts: Manufactured conical tee fitting, conical tap, Fig 3-6; or 45 degree conical lateral fitting, Fig 3-5 as indicated on drawings.
   4. Round runout to diffusers from round duct shall be manufactured fittings, conical tee fitting, conical tap, Fig 3-6; or 45 degree conical lateral fitting, Fig 3-5 as indicated on drawings. Provide segmented standing seam(ribbed) on exposed duct in finished spaces.
   5. Runout to Sidewall Grille/Register: Fig 4-6, 45 Degree entry.
   6. Deflectrols; Refer to section 23 3300, Duct Accessories.
   7. Volume control Dampers: Provide volume control damper with locking quadrant at branch connection fitting for runout to diffuser , unless fitting is located over inaccessible ceiling(Refer to Grille Schedule on Drawings for neck mounted volume dampers).

J. Return or exhaust duct branch connections:
   1. Rectangular Branch: Fig 4-6, 45 degree entry with flange and gasket for connection to trunk with a minimum of six screws.

2. Concealed Round Runouts to Rectangular ducts: Manufactured fitting with 45 degree entry, flanged & gasket for connection to trunk with a minimum of six screws. Provide volume control damper with locking quadrant at branch connection in Ductwork Pressure Class 2 inch or less, unless over inaccessible ceiling (unless otherwise indicated).
3. Round runouts to round ducts: Manufactured 45 degree lateral fitting, Fig 3-5 or as indicated on drawings.
4. Runout to Sidewall Grille/Register: Fig 4-6, 45 Degree entry.
5. Entry fittings; Construct for a 45 degree angle to ease the turbulence created by the converging airstream. Increase the minimum length shown in the SMACNA figure for 45 degree entry from 4 inch to 6 inch
6. Volume control Dampers: Provide volume control damper with locking quadrant at branch connection fitting for runout to diffuser , unless fitting is located over inaccessible ceiling(Refer to Grille Schedule on Drawings for neck mounted volume dampers).

K. Branch Duct Split: Fig 4-5 with volume control dampers. Refer to Section 23 3300, Duct Accessories.

L. Transitions (unless otherwise noted): Fig 4-7; Changes in duct sizes shall be made by transitions. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream. Transitions shall be provided between equipment and duct where sizes are not the same.

2.3 MANUFACTURED METAL DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Round and Flat Oval Ducts:
1. Manufacturer-Layout Basis:
   a. United Sheet Metal Company(McGill Airflow).
   b. Other Acceptable manufacturers:
      1) Air Distribution Systems.
      2) BH&W Sheetmetal (Atlanta)
      3) Dixie Sheet metal Products.
      4) Don Park, Inc.
      5) Eastern Sheet metal.
      6) Monroe Metals.
      7) Norlock.
      8) Patton Industries
      9) Semco.
      10) U.S. Air Duct.
      11) West-Spiro Co.

C. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.
1. Manufacturers:

D. Exposed Spiral Duct:
1. Exposed round duct shall be Machine made from round spiral lockseam duct with light reinforcing corrugations with fittings manufactured of at least two gages heavier metal than duct.
2. Size duct lengths to minimize joint connections. All seams shall be fully welded.
3. Spiral seams shall be aligned at duct connections. Provide ribbed fitting elbows to match the appearance of the ribbed spiral duct.

4. Provide factory welded conical manifold taps in lieu of tee fittings. All taps on a single duct section shall be aligned unless otherwise noted.
5. Provide Keating coupling or Spiralmate round duct connector for duct sizes up to 48-inch diameter.
6. Duct sizes larger than 48-inch diameter shall be connected with angle rings with bolts.
7. Duct finish shall be mill phosphatized for field painting. Welds shall be ground smooth.
8. Protect duct from physical damage during shipping and storage. Provide protective covering of corrugated or bubble pack wrapping material.

2.4 FABRICATED HOODS

A. Heat Removal Canopy: Fabricate hoods of 18 gauge, minimum, type 304 stainless steel with #4 finish. Assemble hoods with no exposed fasteners, using liquid tight welds. Ground down and smooth and polish welds. Utilize S.S. angles for hood reinforcing and hem all raw edges. Provide a full perimeter welded condensate gutter with stainless steel drain fitting. Suspend from structure with threaded rods with top of hood at ceiling.

PART 3 EXECUTION

3.1 INSTALLATION

A. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

B. Duct sizes for runouts to Air Terminals and grilles, registers and diffusers shall match the size of the device unless otherwise noted.

C. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

D. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

E. Use double nuts and lock washers on threaded rod supports.

F. Seal all transverse joints in metal supply, exhaust and return ducts.

G. Exposed Round & flat oval duct in finished spaces: Size duct lengths to minimize joints. Align spiral seams at joints. Install longitudinal and transverse joints in least visible locations. Apply sealer to female fitting and assemble where sealer is not visible.

H. Patch Plates/ Duct Cap: Provide where openings in existing ducts are closed. Plate shall be same material as duct being patched and one gauge heavier than scheduled for the duct size and pressure class at the patched location. Secure with sheet metal screws 6 inches maximum on center with a minimum of two screws for each side.

I. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.2 SCHEDULES

A. Ductwork Material:
   1. Low Pressure Supply: Galvanized Steel.
   2. Medium and High Pressure Supply: Manufactured Metal Ductwork and Fittings; Galvanized steel.
   3. General Exhaust: Galvanized Steel.
   4. Exposed Supply in Laboratory areas: Galvanized Steel K-duct.
   5. Louver Plenums: Galvanized Steel.

B. Ductwork Pressure Class:
   1. Supply System: 2 inch.
   2. Supply System upstream of Air Terminal Units: 6 inch (medium pressure).

3. General Exhaust: 2 inch negative.
4. Carbon Monoxide Exhaust: 4 inch negative.
5. Hood Exhaust: 4 inch negative.

END OF SECTION

SECTION 23 3300

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Backdraft dampers.

B. Barometric backdraft dampers.

C. Combination fire and smoke dampers.

D. Duct access doors.

E. Fire dampers.

F. Flexible duct connections.

G. Smoke dampers.

H. Volume control dampers.

1.2 RELATED REQUIREMENTS

A. Section 23 3100 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2002.

B. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

C. UL 33 - Heat Responsive Links for Fire-Protection Service; Underwriters Laboratories Inc.; 2003.

D. UL 555 - Standard for Fire Dampers; Underwriters Laboratories Inc.; 2006.

E. UL 555S - Standard for Leakage Rated Dampers for Use in Smoke Control Systems; Underwriters Laboratories Inc.; 1999.

1.4 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.1 BACKDRAFT DAMPERS

A. Manufacturers: Ruskin BD2A2.

B. Other acceptable manufacturers offering equivalent products: Arrow, American Warming and Ventilating BD-, Cesco , Greenheck, Louvers and Dampers, Nailor Hart, National Controlled Air, Shipman BD-,Pottorff.

C. Minimum rated system velocity: 1500 FPM.

D. Minimum rated spot velocity: 2500 FPM

E. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.2 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Air Balance FS2250A, Greenheck FSD-22, Louvers and Dampers 770, Nailor-Hart 1270, National Controlled Air FSD-3V-57, Prefco 5000, Ruskin FSD36, Safe Aire 772,Pottorff.

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C. Provide factory sleeve and collar for each damper.

D. Multiple Blade Dampers: Fabricate with 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.

E. Operators: UL listed and labeled spring return pneumatic type suitable for operation on 0-20 psig instrument air. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.

F. Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure.

G. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.

H. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.3 DUCT ACCESS DOORS(AP)

A. Manufacturer: Cesco Model *AD.

B. Other acceptable manufacturers offering equivalent products: Airstream, Flexmaster Inspector Series, Nailor Hart Model 0800, National Controlled Air ADR, Prefco, Ruskin, Ventlok,Pottorff.

C. Fabrication:
   1. Factory fabricated in accordance with SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible, Figures 7-2, 7-3 and as indicated.
   2. Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices.
   3. Install minimum 1 inch thick insulation with sheet metal cover for insulated ducts.
   4. Access doors up to 2 inch pressure class:
      a. Less Than 12 inches Square: Secure with sash locks.
      b. Up to 18 inches Square: Provide two hinges and two sash locks.
      c. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.
      d. Larger Sizes: Provide an additional hinge.
   5. Fabricate access doors over 2 inch pressure class in accordance with Figure 7-2.

D. Access doors with sheet metal screw fasteners are not acceptable.

2.4 FIRE DAMPERS(FD)

A. Manufacturer: Ruskin.

B. Other acceptable manufacturers offering equivalent products: Advanced Air, Inc., Air Balance, Air Control Products, Airstream, American Warming and Ventilating, Cesco, Greenheck, Louvers and, Nailor Hart, National Controlled Air, Pacific Air Products, Phillips, Safe-Aire, Shipman, United, Ventco,Pottorff.

C. Fabricate in accordance with NFPA 90A and UL 555 for dynamic systems, and as indicated.

D. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations.

E. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

F. Dampers shall be Type 'A' with breakaway connections, same size as duct unless otherwise noted. Net damper opening of low resistance type 'B' dampers in retracted position shall not be less than 90% of cross sectional area of attached duct.

G. Multiple Fire Damper Assemblies (Vertical Installations; Allowed Only for Sizes Exceeding 48 inches in Length or Width): Fire dampers assembled together to form protection for a single opening shall be provided with steel mullion(s) meeting the requirements of UL 555 Standard for Safety Fire Dampers and Ceiling Dampers.

2.5 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible, Figures 7-8 and 7-9, and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

C. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
   1. Net Fabric Width: Approximately 6 inches wide.
   2. Metal: 3 inches wide, 24 gage thick galvanized steel.

D. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

2.6 SMOKE DAMPERS(SCD)

A. Rectangular Damper Manufacturer: Ruskin SD36.

B. Other acceptable manufacturers offering equivalent products: Air Balance S2250A, Greenheck SMD-22, Nailor Hart 1260, National Controlled Air SSD-3V-57,Pottorff..

C. Round Damper Manufacturers: Ruskin SDRS-25, National Controlled Air SSD-3V-RD, Air Balance, S2250C,Pottorff.

D. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

E. Maximum Differential Pressure: 4 inches W.G.

F. Maximum system velocity: 2000 FPM.

G. Dampers: UL Class II multiple blade type smoke damper, silicone blade edge seals, stainless steel blade end seals, stainless steel or bronze sleeve type bearings, normally closed with sleeve and pneumatic spring return actuator.

2.7 VOLUME CONTROL DAMPERS (MVD).

A. Manufacturer: Ruskin CD35.

B. Other acceptable manufacturers offering equivalent products: Airstream, Arrow, Greenheck, Nailor Hart, National Controlled Air, Prefco,Pottorff.

C. Splitter Dampers:
   1. Material: Same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.

D. Single Blade Dampers: Figure 7-4. Fabricate for duct sizes up to 6 x 30 inch.

E. Multi-Blade Damper: Figure 7-5. Fabricate of opposed blade pattern with maximum blade sizes 8 x 48 inch long. Assemble center and edge crimped blades in galvanized channel frame with suitable hardware; 16 gauge, minimum, steel channel frame with blade stops top and bottom; 16 gauge steel blades with formed edge groove to have 3/8 inch interlock between adjacent blades, with 1/2 inch diameter cadmium plated shaft extended 6 inches beyond frame and blade linkage.

F. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

G. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 3100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before electric duct heaters, coils, fans, automatic dampers, smoke dampers, at fire dampers, combination fire and smoke dampers, multizone zone dampers, after humidifiers, and elsewhere as indicated.

D. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

E. Label access doors as required by NFPA 90A.

F. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

G. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.

H. Demonstrate re-setting of fire dampers to the Owner's representative.

I. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

J. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment See Section; see Section 22 0548.

K. For fans developing static pressures of 5.0 inches and over, cover flexible connections with leaded vinyl sheet, held in place with metal straps.

L. Use splitter dampers only where indicated.

END OF SECTION

SECTION 23 3413

AXIAL HVAC FANS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Propeller fans.

B. Motors and drives.

C. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 23 0513 - Common Motor Requirements for HVAC Equipment.

1.3 REFERENCE STANDARDS

1.4 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements for submittal procedures.

B. Product Data: Provide data on axial fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 23 0510 - General Mechanical Requirements for delivery, storage and protection requirements.

B. Protect motors, shafts, and bearings from weather and construction dust.

PART 2 PRODUCTS

2.1 PROPELLER FANS(PWF)

A. Manufacturers(Belt Drive): Acme DC, Breidert WP, Chicago DCP, Cook XMW, Coolair C, Greenheck SB, ILG PF, Industrial Air 036, Jenn TBW, Penn BF, Twin City WPB.

B. Manufacturers(Direct Drive): Acme F, Breidert SDWA, Chicago DCP, Cook *WD, Coolair UD, Greenheck SE, ILG PV, Industrial Air 003, Jenn *WD, Penn P, Twin City PE.

C. Performance:

D. Impeller: Shaped steel or steel reinforced aluminum blade with heavy hubs, statically and dynamically balanced, keyed and locked to shaft, directly connected to motor or provided with V-belt drive.

E. Frame: One piece, square steel with die formed venturi orifice, mounting flanges and supports, with baked enamel finish.

F. Drive and Sheaves: Drives rated at 1.5 time motor HP, minimum. Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

G. Accessories:
   1. Provide a unit mounted, 130V rated, specification grade, motor rated disconnect switch in Nema housing for fans with single phase motors unless noted otherwise. Provide NEMA 1 housing in interior locations and NEMA 3R in exterior locations.
   2. Backdraft Damper: Multiple blade with offset hinge pin, blades linked.
   3. Safety Screens: Expanded galvanized metal over inlet, motor, drive; to comply with OSHA regulations.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide safety screen where inlet or outlet is exposed.

3.2 STARTING EQUIPMENT

A. Adjust for proper operation within manufacturer's published tolerances.

B. Laser align pulleys.

C. Electronically balance all rotating equipment.

D. Demonstrate proper operation of equipment to the Owner 's designated representative.

3.3 SCHEDULES

A. Refer to Schedule on Drawings

END OF SECTION

SECTION 23 3423

HVAC POWER VENTILATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof exhausters.

B. Roof upblast exhausters.

C. Inline centrifugal fans.

1.2 RELATED REQUIREMENTS

A. Section 23 0513 - Common Motor Requirements for HVAC Equipment.

B. Section 23 0548 - Vibration and Seismic Controls for HVAC Piping and Equipment.

1.3 REFERENCE STANDARDS

A. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 1994 (Reapproved 2008).

B. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2005.

C. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 2006.

D. UL 705 - Power Ventilators; Underwriters Laboratories Inc.; 2006.

1.4 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Refer to Section 23 0510 - General Mechanical Requirements for delivery, storage and protection requirements.

B. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.7 FIELD CONDITIONS

1.8 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Provide a second adjustable sheave for each belt driven fan to place belt at mid-position of sheave at RPM required for final air balance.

PART 2 PRODUCTS

2.1 ROOF EXHAUSTERS(RF)

A. Manufacturers: Acme PL, Breidert S, Cook HLC, Greenheck LB, Penn LC, Powerline BAE, Twin City BLCH.

B. Product Requirements:
   1. Fabrication: Conform to AMCA 99.
   2. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

C. Motor: Refer to Section 23 0513.

D. Fan Unit: V-belt as indicated, with low silhouette spun aluminum housing hinged for servicing with stainless steel restraining cables; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

E. Roof Curb: Curb height shall provide 8 inch clear above roofing, of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, and factory installed nailer strip.

F. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor. Provide NEMA 1 housing for interior locations and NEMA 3R for exterior locations.

G. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.

H. Drive and Sheaves: Drives rated at 1.5 time motor HP, minimum. Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.2 ROOF UPBLAST EXHAUSTERS (URF)

A. Manufacturers: Acme PU, Breidert TB, Cook ACRU, Greenheck CUBE, Penn Fume-X, Twin City BCRU.

B. Product Requirements:
   1. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal per AMCA 261.
   2. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal per AMCA 261.
   3. Fabrication: Conform to AMCA 99.
   4. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

C. Motor: Refer to Section 23 0513 .

D. Fan Unit: V-belt or direct driven as indicated, with spun aluminum upblast venturi housing with windband; backwardly inclined aluminum wheel, resilient mounted motor with motor and drive in a separate ventilated enclosure with clean air breather tube and removable aluminum cover; 0.62 inch thick aluminum wire birdguard; square base to suit roof curb with continuous curb gaskets. Provide solid state speed controller on direct driven fans.

E. Roof Curb: Curb height shall provide 8 inch clear above roofing, of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, and factory installed nailer strip.

F. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor. Provide NEMA 1 housing in interior locations and NEMA 3R in exterior locations. Provide NEMA 1 housing for interior locations and NEMA 3R for exterior locations.

G. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.

H. Drive and Sheaves: Drives rated at 1.5 time motor HP, minimum. Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.3 INLINE CENTRIFUGAL FANS(ILC)

A. Manufacturers: Acme XB, Breidert BIC, Cook SQI, Greenheck BSQ, Peerless Centrifan, Powerline BCSL, Twin City BSI.

B. Product Requirements:
1. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal per AMCA 261.
2. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal per AMCA 261.
3. Fabrication: Conform to AMCA 99.
4. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

C. Motor: Refer to Section 23 0513.

D. Fan Unit: Air foil centrifugal fan with V-belt or direct driven as indicated, belt guard, companion flanges, inlet cone, flow vanes, grease lubricated with external fittings, and access door.

E. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor. Provide NEMA 1 housing for interior locations and NEMA 3R for exterior locations.

F. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.

G. Drive and Sheaves: Drives rated at 1.5 time motor HP, minimum. Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

D. Suspended Fans:
1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 23 0548.
2. Install flexible connections specified in Section 23 3300 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

E. Provide a second adjustable sheave to place belt at mid-position of sheave at RPM required for final air balance.

F. Install backdraft dampers on inlet to roof and wall exhausters.

G. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

3.2 STARTING EQUIPMENT

A. Adjust for proper operation within manufacturer's published tolerances.

B. Laser align pulleys.

C. Electronically balance all rotating equipment.

D. Demonstrate proper operation of equipment to the Owner 's designated representative.

END OF SECTION

SECTION 23 3516

ENGINE EXHAUST SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Ductwork and duct fittings.

B. Inlet fittings.

C. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment: Vibration isolators.

B. Section 23 0513 - Common Motor Requirements for HVAC Equipment: Fan motors.

C. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ACGIH (IV) - Industrial Ventilation, A Manual of Recommended Practice; American Council of Governmental Industrial Hygienists; 2007, 26th edition.

B. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2001 (Reapproved 2007).

C. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 2007 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).

D. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.; http://www.amca.org/licenses/search.aspx.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2005.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 2006.

G. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2007.

H. ASTM D 2996 - Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe; 2001 (Reapproved 2007).

I. ASTM D 2997 - Standard Specification for Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe; 2001 (Reapproved 2007).

J. AWS D9.1M/D9.1 - Sheet Metal Welding Code; American Welding Society; 2006.

K. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

L. SMACNA (RIDC) - Rectangular Industrial Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2004.

M. SMACNA (ROUND) - Round Industrial Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 1999.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers literature and data sheets indicating rated capacities, dimensions, weights and point loadings, accessories, electrical characteristics and connection requirements, wiring diagrams, and location and sizes of field connections.
   1. Provide fan curves with specified operating point clearly plotted.

C. Shop Drawings: Indicate dimensions, sizes, weights and point loadings, and locations and sizes of field connections.

D. Manufacturer's Installation Instructions: Include assembly and installation instructions.

E. Operation and Maintenance Data: Include instructions for fan lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Fan Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

B. Fan Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

C. Fan Fabrication: Conform to AMCA 99.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Car-Mon Products: www.car-mon.com.

B. Flexaust: www.flexaust.com.

C. Fume-a-vent_____.

D. Engwald.

E. Ventaire.

2.2 CENTRIFUGAL FANS

A. Wheel and Inlet: Steel construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded to flange and back plate; cast iron hub riveted to back plate and keyed to shaft with set screws.

B. Housing: Heavy gage steel, spot welded with inlet bell and shaped cut-off, factory finished with enamel or prime coat.

C. Motors and Drives:
   1. Bearings: Heavy duty pillow block type, self aligning, grease-lubricated ball bearings or roller bearings.
   2. Shafts: Hot rolled steel, ground and polished, with key-way, protectively coated with lubricating oil.
   3. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed, variable and adjustable pitch, matched belts, and rated minimum 1.5 times nameplate rating of motor.
   4. Belt Guard: Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible; of 12 gage, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated.

2.3 DUCTWORK AND DUCT ACCESSORIES

A. Materials:

1. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M FS Type B, with G90/Z275 coating.
2. Glass Fiber Reinforced Plastic Ducts: ASTM D 2996 or ASTM D 2997.

B. Ductwork:
1. Fabricate and support in accordance with:
   a. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible.
   b. SMACNA (ROUND) - Round Industrial Duct Construction Standard and SMACNA (RIDC) - Rectangular Industrial Duct Construction Standard.
2. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline.
3. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
4. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard.
5. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow, with liquid adhesive plus sheet metal screws.
6. Joints: Minimum 4 inch cemented slip type, brazed or electric welded to AWS D9.1M/D9.1. Prime coat welded joints.
7. Provide standard 45 degree lateral wye branch fittings unless otherwise indicated.
8. Use double nuts and lock washers on threaded rod supports.

C. Flexible Connectors: UL listed, fire-retardant polyethylene impregnated fabric, minimum density 20 oz per sq yd, approximately 2 inches wide, crimped into metal edging strip.

D. Blast Gates: Half collar of cast aluminum, with galvanized steel slide.

2.4 EXHAUST SYSTEM ACCESSORIES

A. Tail Pipe Adapters: Rubber formed to tapered cone with spring clip attachment, adapter size 6 inch, for connection to 2-1/2 inch diameter hose with pull-down ring on cone.

B. Flexible Exhaust Hose: Heat resistant neoprene coated fabric spring steel wire reinforced, rated for duty to 260 degrees F and 20 inches WG positive or negative.

C. Overhead Suspension System: System to support overhead hose consisting of 5/16 inch diameter nylon cable, 2 inch diameter cadmium plated cast steel swivel pulleys, 6 inch cadmium plated cast steel cleats.

D. Exhaust Hose Reel: Spring operated, manually controlled reel consisting of metal cylinder with internal aluminum flexible pipe, zinc plated steel stand, two steel springs, brake mechanism, hose stop, hose guide and 16 feet of 4 inch diameter hose.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturers instructions.

B. Install fans with resilient mounting and flexible electrical leads. Refer to Section 22 0548 and Section 26 2717.

C. Install flexible connections at fan inlet and discharge. Ensure metal bands of connectors are parallel with minimum 1 inch flex between ductwork and fan while running.

D. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

END OF SECTION

SECTION 23 3600

AIR TERMINAL UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable volume terminal units.

B. Fan powered terminal units.

1.2 RELATED REQUIREMENTS

A. Section 23 0513 - Common Motor Requirements for HVAC Equipment.

B. Section 23 3100 - HVAC Ducts and Casings.

1.3 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements for submittal procedures.

B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.

D. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 to 4 inch wg.

E. Manufacturer's Installation Instructions: Indicate support and hanging details, and service clearances required.

F. Project Record Documents: Record actual locations of units.

G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant volume regulators.

1.4 DELIVERY, STORAGE, AND PROTECTION

A. Refer to Section 23 0510 - General Mechanical Requirements for delivery, storage and protection requirements.

B. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

PART 2 PRODUCTS

2.1 SINGLE DUCT VARIABLE VOLUME UNITS

A. Manufacturers:
   1. Titus ESV
   2. Other acceptable manufacturers offering equivalent products: Anemostat VF-PVM, Buensod BTUO, Envirotech SDRWC, Krueger LMHS, Metal-Aire TH, EH Price, Trane VC, Tuttle&Bailey SDV, Nailor Model 3001.

B. Basic Assembly:
   1. Casings: Minimum 22 gage galvanized steel.
   2. Lining: Minimum 1/2 inch thick neoprene or vinyl coated fibrous glass insulation, 1.5 lb/cu ft density, meeting NFPA 90A requirements and UL 181 erosion requirements.
   3. Plenum Air Inlets: Round stub connections for duct attachment.

4. Plenum Air Outlets: S slip and drive connections.

C. Basic Unit:
1. Configuration: Air volume damper assembly inside unit casing. Locate control components inside protective metal shroud.
2. Volume Damper: Construct of galvanized steel with peripheral gasket and self lubricating bearings; maximum damper leakage: 2 percent of design air flow at 6 inches inlet static pressure.
3. Airflow Sensor: All terminals shall be equipped with a factory furnished and mounted multi-point, flow ring or cross arrangement inlet averaging aluminum or stainless steel sensor which will provide a differential pressure signal that represents actual air flow within an accuracy of +5% regardless of inlet configuration. This accuracy shall be maintained when inlet duct varies from straight up to 90 elbow entrance conditions for both flexible and rigid metal duct applications. Straight inlet duct shall not be required for specified accuracy.

D. Electric Heating Coil:
1. Construction: ETL listed, slip-in type, proportionally modulated ,open coil design 80/20 nickel/chrome elements, integral control box factory wired and installed on the terminal by the terminal manufacturer.
2. Controls:
   a. Door interlock disconnect switch
   b. Line and Control terminal blocks
   c. Auto reset primary and manual reset secondary over-temperature protection
   d. Proportional electronic airflow proof sensor integrated with SCR controller
   e. SCR controller to modulate heater output according to temperature control signal.
   f. Control transformer.
   g. Heater control panel housed in a NEMA 1 enclosure with hinged access door. Door shall be sized to allow easy access to all control components
3. Proportional SCR Controller:
   a. Airflow sensor: Proportional electronic airflow sensor shall be totally independent of the duct static pressure sensors/controls. Controller shall use the sensor to adjust the heater capacity based on the available airflow. The heaters shall deliver up to maximum heating capacity (controlled by input signal from BAS) when air flow is at scheduled minimum. When airflow is below minimum, controller shall reduce capacity (regardless of control signal) in proportion to the airflow reduction and stop heating when there is no airflow.
   b. Capacity control: Proportional SCR controller shall modulate the heater output according to the temperature control (BAS) signal. Controller shall be able to utilize at least one of the following control signals as input to modulate heater: Variable 0-10 volts, pulse width modulation or variable 2-20 mA variable current

E. Automatic Damper Operator:
1. Electric Actuator: Modulating 24 volt with high limit.

F. Controller:
1. Digital: Factory mount DDC controller and damper actuator supplied by building automation control manufacturer within unit mounted enclosure.
2. Wiring:
   a. Factory mount and wire controls. Mount electrical components in control box with removable cover. Incorporate single point electrical connection to power source.
   b. Factory mount transformer for control voltage on electric and electronic control units. Provide terminal strip in control box for field wiring of thermostat and power source.
   c. Wiring Terminations: Wire controls to terminal strip. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

2.2 FAN POWERED VARIABLE VOLUME UNITS

A. Manufacturers
   1. Titus TQS. Straight through design.
   2. Other acceptable manufacturers offering equivalent products: Buensod CFD, Krueger QFC, Metal-Aire Series 400 FCI, EH Price FPC/FEC, Tuttle&Bailey FPC, Nailor 35P, Trane Model VP.

B. Basic Assembly:
   1. Casings: Minimum 22 gage galvanized steel.
   2. Lining: Minimum 1/2 inch thick neoprene or vinyl coated fibrous glass insulation, 1.5 lb/cu ft density, meeting NFPA 90A requirements and UL 181 erosion requirements.
   3. Plenum Air Inlets: Round stub connections and S slip and drive connections for duct attachment.
   4. Plenum Air Outlets: S slip and drive connections.

C. Basic Unit:
   1. Configuration: Air volume damper assembly and fan in series arrangement inside unit casing. Locate control components inside protective metal shroud.
   2. Volume Damper: Construct of galvanized steel with peripheral gasket and self lubricating bearings; maximum damper leakage: 2 percent of design air flow at 1 inches rated inlet static pressure.
   3. Airflow Sensor: All terminals shall be equipped with a factory furnished and mounted multi-point, flow ring or cross arrangement inlet averaging aluminum or stainless steel sensor which will provide a differential pressure signal that represents actual air flow within an accuracy of +5% regardless of inlet configuration. This accuracy shall be maintained when inlet duct varies from straight up to 90 elbow entrance conditions for both flexible and rigid metal duct applications. Straight inlet duct shall not be required for specified accuracy.

D. Automatic Damper Operator:
   1. Electric Actuator: Modulating 24 volt with high limit.

E. Fan Assembly:
   1. Fan: Forward curved centrifugal type with direct drive permanent split capacitor type, thermally protected motor. Refer to Section 23 0513.
   2. Speed Control: Infinitely adjustable with electric/pneumatic and electronic controls.
   3. Isolation: Fan/motor assembly on rubber isolators.

F. Electric Heating Coil:
   1. Construction: ETL listed, slip-in type, proportionally modulated ,open coil design 80/20 nickel/chrome elements, integral control box factory wired and installed on the terminal by the terminal manufacturer.
   2. Controls:
      a. Door interlock disconnect switch.
      b. Line and Control terminal blocks.
      c. Auto reset primary and manual reset secondary over-temperature protection
      d. Proportional electronic airflow proof sensor integrated with SCR controller
      e. Magnetic contactor for each step of control.
      f. Control transformer
      g. SCR controller to modulate heater output according to temperature control signal.
      h. heater control panel housed in a NEMA 1 enclosure with hinged access door. Door shall be sized to allow easy access to all control components
      i. Fuse Blocks: Designed to accommodate NEMA FU1, Class R fuses.
   3. Proportional SCR Controller:

a. Airflow sensor: Proportional electronic airflow sensor shall be totally independent of the duct static pressure sensors/controls. Controller shall use the sensor to adjust the heater capacity based on the available airflow. The heaters shall deliver up to maximum heating capacity (controlled by input signal from BAS) when air flow is at scheduled minimum. When airflow is below minimum, controller shall reduce capacity (regardless of control signal) in proportion to the airflow reduction and stop heating when there is no airflow.

b. Capacity control: Proportional SCR controller shall modulate the heater output according to the temperature control (BAS) signal. Controller shall be able to utilize at least one of the following control signals as input to modulate heater: Variable 0-10 volts, pulse width modulation or variable 2-20 mA variable current

G. Wiring:
1. Factory mount and wire controls. Mount electrical components in control box with removable cover. Incorporate single point electrical connection to power source.
2. Factory mount transformer for control voltage on electric and electronic control units. Provide terminal strip in control box for field wiring of thermostat and power source.
3. Wiring Terminations: Wire fan and controls to terminal strip. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
4. Disconnect Switch: Factory mount fused disconnect switch in control panel.

H. Controller:
1. Digital: Factory mount DDC controller and damper actuator supplied by building automation control manufacturer within unit mounted enclosure.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Support units individually from structure. Do not support from adjacent ductwork.

C. Attach supports to unit without obstructing removable casing panels, control cabinets or other items requiring access for service.

D. Install terminal units in a readily accessible location. Refer to definitions in Section 23 0510.

E. Coordinate with the Contractor so that other trades do not obstruct removable casing panels or other items requiring access for service.

F. Connect to ductwork in accordance with Section 23 3100.

G. Provide minimum of 5 ft of lined ductwork downstream of units.

H. Verify that electric power is available and of the correct characteristics.

3.2 SCHEDULES

A. Refer to Schedule on Drawings.

B. Terminal Unit Schedule
1. All cfm's based on 0.45 inches upstream static and 0.375 inches downstream resistance.
2. Maximum inlet velocity 2,000 FPM.
3. Max. N.C. shall be 30, based on 3 feet lined duct downstream and 10 Db room absorption.

END OF SECTION

SECTION 23 3700

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers

B. Registers/grilles

C. Door grilles

D. Louvers

1.2 REFERENCE STANDARDS

A. ASHRAE Std 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.; 2006.

1.3 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

PART 2 PRODUCTS

2.1 ROUND CEILING DIFFUSERS (RCD)

A. Manufacturer: Titus Model TMRA (steel) or TMRA-AA (aluminum).

B. Other acceptable manufacturers offering equivalent products:
1. Nailor 6300R.
2. Carnes SSAA.
3. Price RCDA.
4. Krueger RA.
5. Metal-Aire.
6. Tuttle & Bailey VJS.

C. Type: Round, adjustable pattern, stamped or spun, multi-core diffuser to discharge air in 360 degree pattern, with sectorizing baffles where indicated.

D. Fabrication for Steel Diffusers: 18 gauge, minimum, Steel with baked enamel finish with color as scheduled on drawings.

E. Fabrication for Aluminum Diffusers: .051, minimum, aluminum with baked enamel finish with color as scheduled on drawings.

F. Accessories:
1. Radial opposed blade volume damper adjustable from diffuser face where scheduled on Drawings.

2.2 RECTANGULAR LOUVERED FACE (RLF1) CEILING DIFFUSERS

A. Manufacturer: Titus Model TMS.

B. Other acceptable manufacturers offering equivalent products:
1. Nailor Model RNS.
2. Carnes Model SJTA.
3. Price Model RCDA.

4. Krueger Model SH-FR23.
5. Metalaire Model 5700.
6. Tuttle & Bailey Model 'S1200'

C. Type: Square and rectangular, adjustable pattern, multi-louvered diffuser with round neck duct connection and rod mounted air pattern deflectors as required by pattern indicated on floor plans.

D. Frame: Surface Mount, Snap-In, Inverted T-Bar(Lay-in), or Spline type to match ceiling. Refer to schedule on Drawings. A rapid mount plaster sub-frame may be substituted to convert a Lay-in frame for use in a sheetrock or plaster ceiling provided that the diffuser & frame match the face size specified.

E. Fabrication: Diffusers shall be constructed of 24 gauge steel or 0.04 aluminum and shall have a finish as scheduled.

F. Dimensions:
1. The diffuser neck shall have a minimum 1 1/8-inch depth for duct connection.

G. Accessories:
1. Radial opposed blade damper adjustable from diffuser face as scheduled on drawings.

2.3 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES(CGC)

A. Manufacturer: Titus Model 50F

B. Other acceptable manufacturers offering equivalent products:
1. Anemostat GC5
2. Carnes RAPAF
3. Price 80
4. Krueger RA
5. MetalAire CC5
6. Tuttle & Bailey CRE500

C. Type: Fixed grilles of 1/2 x 1/2 x 1/2 inch louvers.

D. Fabrication: Aluminum with factory clear lacquer finish.

E. Frame: 1-1/4 inch margin with countersunk screw mounting.

F. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.4 CEILING SLOT DIFFUSERS(CSD1)

A. Manufacturer: Titus Model ML-*(supply) or MLR-*(return)

B. Other acceptable manufacturers offering equivalent products:
1. Anemostat SLAD
2. Price SDS75
3. Krueger 1900-B
4. MetalAire
5. Tuttle & Bailey 6*00F

C. Type: Number and width of slots and length as scheduled and with adjustable vanes for left, right, or vertical discharge.

D. Fabrication: Aluminum extrusions with frame and border type as specified. Provide factory finish of clear lacquer, off-white enamel or baked enamel (color to be selected) as scheduled on drawings. Adjustable vanes shall be finished flat black.

E. Frame for mounting in sheetrock Ceilings 1-1/4 inch margin with concealed mounting and gasket.

F. Plenum: Integral, galvanized steel, insulated. Fabricate to lengths indicated in schedule.

G. Accessories: Provide hanger brackets, spring clips, alignment pins for continuous appearance of multiple sections, end caps and mitered corners to match diffuser type specified and arrangement shown.

2.5 WALL SUPPLY REGISTERS/GRILLES(WSAR):

A. Manufacturer: Titus Model 300RS.

B. Other acceptable manufacturers offering equivalent products:
1. Anemostat .
2. Carnes .
3. Price .
4. Krueger 620/F/D.
5. MetalAire Y4004S.
6. Tuttle & Bailey T647.

C. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, double deflection.

D. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

E. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory baked enamel finish, color to be selected.

F. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.6 WALL SUPPLY REGISTERS/GRILLES-ROUND NOZZLE(WSAR-R):

A. Manufacturer: Air Concepts Model APL-Aluminum Puhkah Louver.

B. Other acceptable manufacturers offering equivalent products:
1. Anemostat.
2. MetalAire.
3. Tuttle & Bailey.

C. Type: Concentric ring nozzle elements mounted in a square or rectangular panel frame. Minimum of three rolled deflection rings, adjustable through a plus or minus 30-degree pivot angle and a rotation of 360-degrees.

D. Frame: Heavy gage metal construction with countersunk screw mounting and gasket.

E. Fabrication: Aluminum or steel with 18 gage minimum frames and 20 gage minimum nozzle elements with factory baked enamel finish, off-white.

F. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.7 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Manufacturer: Titus Model 350RL.

B. Other acceptable manufacturers offering equivalent products:
1. Krueger.
2. MetalAire .
3. Tuttle & Bailey T70D.

C. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with 35 degree, minimum fixed blade deflection, horizontal face.

D. Frame: 1-1/4 inch margin with countersunk screw mounting.

E. Fabrication: Steel frames and blades, with factory finish.

F. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.8 DOOR GRILLES(DG)

A. Manufacturer: Titus Model T700.

B. Other acceptable manufacturers offering equivalent products:
1. Anemostat NS.
2. Carnes RGHAC.
3. Price STG.
4. Krueger 77C.
5. MetalAire DGDF.
6. Tuttle & Bailey GDV.

C. Type: V-shaped sight-proof blades of 20 gage thick steel, 1 inch deep on 1/2 inch centers.

D. Frame: 20 gage steel with auxiliary frame to give finished appearance on both sides of door, with factory prime coat finish.

2.9 LOUVERS-ALUMINUM-DRAINABLE BLADE STYLE

A. Manufacturer: Ruskin Model ELF-6375DX.

B. Other acceptable manufacturers offering equivalent products:
1. American Warming & Ventilating LE-33.
2. Air Balance .
3. Dowco DW-6.
4. Greenheck ESD-603.
5. Industrial Louvers 653.
6. Louvers & Dampers lEL-6.
7. Shipman LE-33.
8. Tuttle & Bailey DB-645.

C. Type: 6 inch deep with blades on 45 degree slope, drainable blade with gutter, heavy channel frame, 19 gauge birdscreen with 1/2 inch square mesh for exhaust and 3/4 inch for intake.

D. Fabrication: 12 gage thick extruded aluminum, welded assembly, with factory baked enamel finish color to be selected.

E. Mullions: Provide hidden or exposed mullions to support blades as shown on architectural elevations.

F. Mounting: Furnish with masonry strap anchors for installation.

G. Insulated Blank-Off Panels:
1. Fabricate louver blank-off panels of materials and sizes indicated and to comply with the following requirements:
a. Finish: Match finish applied to louver with respect to coating type, except for color, which shall be flat black.
b. Attach blank-off panels to back of louver frames with stainless-steel sheet-metal screws.
2. Blank-Off Panels: Laminated metal-faced panels consisting of insulating core surfaced on back and front with metal sheets, complying with the following requirements:
a. Thickness: 2 inches (50 mm).
b. Metal Facing Sheets: Aluminum sheet, 0.032 inch (0.81 mm) thick.

c. Insulating Core: Unfaced, rigid, glass-fiberboard insulation complying with ASTM C612, Class 1 and Class 2.
d. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames 0.081 inch (2.06 mm) thick, with corners mitered and with same finish as panels.
e. Seal perimeter joints between panel faces and louver frames with 1/8 inch by 1 inch (3.2 mm by 25 mm) polyvinyl chloride compression gaskets.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Door grilles: Furnish door grilles to General Contractor for installation by Door Installer.

END OF SECTION

SECTION 23 4000

HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Disposable, extended area panel filters.

B. Extended surface medium efficiency media filters.

1.2 REFERENCE STANDARDS

A. ASHRAE Std 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1992.

B. UL 900 - Standard for Air Filter Units; Underwriters Laboratories Inc.; 2004.

1.3 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements for submittal procedures.

B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.

1.4 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Provide filters whenever any system is operated during construction. Refer to Section 23 0510.

C. Provide one set of disposable panel filters at Final Observation.

PART 2 PRODUCTS

2.1 DISPOSABLE, EXTENDED AREA PANEL FILTERS(EAPF)

A. Manufacturers: American Air Filter AM-AIR, Air Guard, CamFil-Farr 30/30,Purolator.

B. Media: UL 900 Class 2, pleated, lofted, non-woven, reinforced cotton fabric; supported and bonded to welded wire grid.
   1. Frame: Cardboard.
   2. Nominal size: 24 x 24 inches.
   3. Nominal thickness: 2 inches.

C. Rating, per ASHRAE Std 52.1:
   1. Dust spot efficiency: 25-30 percent.
   2. Weight arrestance: 90-92 percent.
   3. Recommended final resistance: 0.9 inch WG.

2.2 EXTENDED SURFACE MEDIUM EFFICIENCY MEDIA FILTERS(ESMF)

A. Manufacturers: American Air Filter Varicel, ECO-AIr Ecopac, CamFil-Farr Riga-Flo:

B. Media: Pleated, water-resistant glass fiber with aluminum separators; in 16 gage steel holding frame with corrosion resistant coating.
   1. Nominal Size: 24 x 24 x 12 inches deep.

C. Performance Rating, per ASHRAE Std 52.2:
   1. Efficiency- MERV 13 percent.
   2. Initial Resistance at 500 FPM Face Velocity:.55 inch WG.
   3. Recommended Final Resistance: 1.2 inch WG.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

D. Do not install second stage medium or high efficiency filters until project is complete and ready for balancing.

E. Provide sheetmetal angle frame to support filters from cooling coil support and 20 gauge sheetmetal safing to prevent bypass airflow around filters.

3.2 SCHEDULES

A. Provide filter media for Air Handling Units specified in section 23 7313.

B. Refer to Schedule on Drawings.

END OF SECTION

SECTION 23 5533

FUEL-FIRED UNIT HEATERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Gas fired unit heaters.

B. Tubular infrared heaters.

1.2 RELATED REQUIREMENTS

A. Section 23 0510 - General Mechanical Requirements

B. Section 23 5100 - Breechings, Chimneys, and Stacks.

C. Section 23 0913 - Instrumentation and Control Devices for HVAC: Thermostats, time clocks.

1.3 REFERENCE STANDARDS

A. ASHRAE Std 90.1 - Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2004.

B. ASHRAE Std 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1993 with 1996 Errata.

C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2002.

D. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; National Fire Protection Association 2006.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

B. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.

D. Warranty: Submit manufacturers warranty and ensure forms have been filled out in the Owner s name and registered with manufacturer.

1.5 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.6 WARRANTY

A. See Section 23 0510 - General Mechanical Requirements, for warranty requirements.

B. Provide five year manufacturers warranty for heat exchangers.

PART 2 PRODUCTS

2.1 GAS FIRED UNIT HEATERS

A. Manufacturers:
   1. Layout Basis: Reznor Model SFT.

2. Other Acceptable Manufacturers:
   a. Airtherm.
   b. Carrier.
   c. Modine.
   d. Trane.

B. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner, controls, and accessories. Entire assembly shall be AGA approved for installation shown.
   1. Heating: Natural gas fired.
   2. Discharge Louvers: Individually adjustable horizontal louvers to match cabinet finish.
   3. Air Filters: Filter cabinet with 2 inch thick glass fiber, disposable type filters.

C. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner. Cabinet shall be designed for ceiling suspension with threaded hanger connections with factory hanger kit.

D. Supply Fan: Propeller type with direct drive.

E. Heat Exchanger: Aluminized steel welded construction with flared ports and stainless steel inserts with minimum of 80% thermal efficiency.

F. Vertical combustion air inlet/vent terminal assembly to allow single roof termination for combined exhaust and combustion air, arranged to provide preheating of combustion air.

G. Gas Burner:
   1. Fan assisted type with adjustable combustion air supply.
   2. Gas valve, two stage provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off) main and pilot valves, pilot filtration, automatic electric valve designed to provide scheduled performance at 5-14 inches w.c. inlet gas pressure.
   3. Electronic pilot ignition, with intermittent electric spark igniter with electronic flame supervision and timed lockout.
   4. Non-corrosive combustion air blower with permanently lubricated motor.

H. Gas Burner Safety Controls:
   1. Thermocouple sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
   2. Combustion air pressure differential switch to verify proper vent flow before allowing operation of the gas valve.
   3. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature, automatic resets.

I. Operating Controls
   1. Factory single stage, 24-volt room thermostat cycles burner to maintain room temperature setting.
   2. Control Power Transformer: 24-Volt, 90 VAC control power transformer for control valve and thermostat power. Provide factory terminal block wiring.
   3. Supply Fan Control: Energize from bonnet temperature independent of burner controls, with adjustable timed off delay and fixed timed on delay, with manual switch for continuous fan operation.

J. Performance:
   1. Ratings: Energy Efficiency Rating (EER)/Coefficient of Performance (COP) not less than requirements of ASHRAE Std 90.1; seasonal efficiency to ASHRAE Std 103.

2.2 TUBULAR INFRARED HEATERS

A. Manufacturers: Reznor (VR), Space Ray (LTU), Solaronics (Suntube), AmbiRad (VPlus)

B. Units: Packaged, partially factory assembled, pre-wired unit consisting of cabinet, burner, heat exchanger, radiant tube, reflector, controls; for natural gas.

C. Heat Exchanger: Aluminized tubular steel combustion chamber with aluminized steel tube with aluminum reflector.

D. Gas Burner:
   1. Gas Burner: Forced draft type with adjustable combustion air supply.
   2. Gas valve provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
   3. Electronic pilot ignition, with electric spark igniter.
   4. Non-corrosive burner air blower with permanently lubricated motor.

E. Gas Burner Safety Controls: Thermo-couple sensor prevents opening of solenoid gas valve until pilot flame is proven and stops gas flow on ignition failure.

F. Operating Controls: Low voltage room thermostat cycles burner to maintain room temperature setting.

G. Accessories: Vertical combustion air inlet/vent terminal assembly to allow single roof termination for combined heater exhaust or combustion air.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that space is ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available.

C. Verify that proper fuel supply is available for connection.

3.2 INSTALLATION

A. Install in accordance with NFPA 90A.

B. Install gas fired units in accordance with NFPA 54 and applicable codes.

C. Provide vent connections in accordance with NFPA 211. Refer to Section 23 5100.

D. Install unit heaters with vibration isolation. Refer to Section 22 0548.

E. Install factory thermostats in accordance with manufacturer's instructions as located on drawings. Thermostats shall cycle gas unit heaters through factory safeties and controls to maintain setpoint.

3.3 SCHEDULES

A. Refer to schedule on drawings.

END OF SECTION

SECTION 23 6419

RECIPROCATING WATER CHILLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Chiller package.

B. Charge of refrigerant and oil.

C. Controls and control connections.

D. Chilled water connections.

E. Starters.

1.2 RELATED REQUIREMENTS

A. Section 22 0513 - Common Motor Requirements for Plumbing Equipment.

B. Section 23 2113 - Hydronic Piping.

C. Section 23 2123 - Hydronic Pumps.

D. Section 23 0913 - Instrumentation and Control Devices for HVAC.

E. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

F. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ARI 550/590 - Standard for Water Chilling Packages Using the Vapor Compression Cycle; Air-Conditioning and Refrigeration Institute; 2003.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2007.

C. ASME (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers; 2007.

D. NEMA ICS 6 - Industrial Control and Systems: Enclosures; National Electrical Manufacturers Association; 1993 (R2006).

E. UL 1995 - Heating and Cooling Equipment; Underwriters Laboratories Inc.; 2005.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

C. Shop Drawings: Indicate components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate valves, strainers, and thermostatic valves required for complete system.

D. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.

E. Control Interlocks: Provide machine specific wiring diagrams to the control vendor. Review and approve control manufacturers interlock diagrams.

F. Manufacturer's Certificate: Certify that components of package not furnished by manufacturer have been selected in accordance with manufacturer's requirements.

G. Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls, and accessories. Include trouble-shooting guide.

H. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in the Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

1.7 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide a five year warranty to include coverage for compressor including materials only.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Carrier Corporation; Model 30GT: www.carrier.com.

B. Trane Inc; Model CGA: www.trane.com.

C. YORK; Model YCA: www.york.com.

2.2 MANUFACTURED UNITS

A. Provide factory assembled and tested outdoor air cooled liquid chillers consisting of compressors, condenser, evaporator, thermal expansion valve, refrigeration accessories, and control panel. Construction, testing, and ratings shall be in accordance with ARI 550/590.

B. UL listed and labeled.

C. Conform to ASME (BPV VIII, 1) Boiler and Pressure Vessel Code for construction and testing of reciprocating water chillers.

D. Conform to ASHRAE Std 15 for construction and operation of water chillers.

E. Energy Efficiency for air-cooled units:

2.3 HERMETIC COMPRESSORS

A. Reciprocating Compressors:
   1. Unit: Hermetically sealed motor-compressor with crankcase heater, suction and discharge service valves, rubber-in-shear isolators, and control panel.
   2. Motor: Constant speed 3600 rpm, suction gas cooled with overheating protection.
   3. Crankcase Heater: Energize continuously.
   4. Controls: Factory wired for crankcase heater, terminal strip for connection to power with electronic protection module incorporating overload and single phase protection, high discharge temperature, and anti-recycling timer.

B. Scroll Compressors:
   1. Unit: Direct drive, hermetic, 3600 RPM, fixed compression, scroll motor-compressor with control panel.

2. Features: Centrifugal oil pump, sump oil heater, oil level sight glass, oil charging valve, two point lubrication for each motor bearing, flooded lubrication for the journal and thrust bearings, check valve on scroll discharge port.
3. Motor: Suction gas cooled, hermetically sealed, squirrel cage induction.
4. Controls:
   a. Starter section:
      1) Non-fused molded case disconnect switch.
      2) Single point power connection and grounding lug.
      3) Control power transformer with fuse.
      4) Solid state overload relay for each compressor.
      5) Phase loss/reversal monitor.
      6) Cycle counter and hour meter per compressor.
   b. Refrigeration section:
      1) Anti-recycle timer.
      2) Reset relay.
      3) Reset switch.
      4) Low and high pressure control.
      5) Motor winding temperature protection.
   c. Manual reset for compressor overload, high motor temperature, and low and high refrigerant pressure.

2.4 SEMI-HERMETIC COMPRESSORS

A. Screw Compressors:
1. Unit: Direct drive, semi-hermetic 3600 RPM, fixed compression, rotary screw compressor with control panel.
2. Features: Differential refrigerant pressure oil pump, oil heater, oil separator and filter, oil charging valve.
3. Motor: Suction gas cooled, hermetically sealed, squirrel cage induction.
4. Controls:
   a. Non-fused molded case disconnect switch.
   b. Single point power connection and grounding lug.
   c. Anti-recycle timer.
   d. Low and high pressure control.
5. Automatic Capacity Reduction: Continuously variable slide valve with infinitely variable control to 25 percent of full load.

2.5 EVAPORATOR

A. Provide shell and tube type evaporator, seamless or welded steel construction with cast iron or fabricated steel heads, seamless copper tubes or red brass tubes with integral fins, rolled or silver brazed into tube sheets. Pipe connections shall be grooved pipe fittings. Provide multiple refrigerant circuits on multiple compressor units.

B. Design, test, and stamp refrigerant side for 225 psig working pressure and water side for 150 psig working pressure, minimum; in accordance with ASME (BPV VIII, 1).

C. Electric heating cable with thermostat to protect the evaporator from freezing down to -20 degrees F.

D. Insulate with 0.75 inch minimum thick flexible expanded polyvinyl chloride insulation with maximum K value of 0.28. Provide heat tape to protect evaporator to -20 degrees F.

E. Provide water vent and drain connection and thermometer wells for temperature controller and low temperature cutout.

2.6 CONDENSERS

A. Construct condenser coils of aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits with liquid accumulators. Air test under water to 425 psig.

B. Provide vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Equip with roller or ball bearings with grease fittings extended to outside of casing. Provide factory mounted, louvered, galvanized steel coil guard panels with lint screens.

C. Provide fan motors with permanently lubricated ball bearings and built-in current and overload protection. Refer to Section 22 0513.

2.7 ENCLOSURES

A. House components in welded steel frame with galvanized steel panels with weather resistant, baked enamel finish.

B. Protect components underneath unit with tamperproof welded wire mesh guards.

C. Mount starters and disconnects in NEMA ICS 6 weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power when door is opened.

2.8 REFRIGERANT CIRCUIT

A. Provide two completely separate refrigerant circuits.

B. Provide for each refrigerant circuit:
1. Liquid line solenoid valve.
2. Filter dryer (replaceable core type).
3. Liquid line sight glass and moisture indicator.
4. Thermal expansion valve sized for maximum operating pressure.
5. Charging valve.
6. Insulated suction line.
7. Discharge line check valve.
8. Compressor discharge service valve.
9. Condenser pressure relief valve.
10. Suction line accumulator.

2.9 CONTROLS

A. Mount NEMA ICS 6 weatherproof steel control panels with wind struts on chiller, containing starters, power and control wiring, factory wired with single point power connection. Separate power and controls into separate compartments.

B. Provide safety controls arranged so any one will shut down machine and require manual reset:
1. Low chilled water temperature switch.
2. High discharge pressure switch for each compressor.
3. Low suction pressure switch for each compressor.
4. Oil pressure switch.
5. Flow switch in chilled water line.

C. Cycle counter and hour meter per compressor.

D. Provide operating controls:
1. Multi-step chilled water temperature controller that cycles compressors and activates cylinder unloaders.
2. Adjustable Five to ten minute off timer prevents compressor from short cycling.
3. Periodic pump-out timer to pump down on chilled water flow and high evaporator refrigerant pressure.
4. Load limit thermostat to limit compressor loading on high return water temperature.

5. Low ambient control consisting of external damper assembly, controls head pressure for operation down to 0 degrees F.
6. Hot gas bypass sized for minimum compressor loading on one compressor only, bypasses hot refrigerant gas to evaporator.

E. Provide pre-piped gauge board with pressure gauges for suction and discharge refrigerant pressures, and oil pressures for each compressor.

2.10 POWER WIRING

A. Provide factory wired units with a single point of electrical connection and grounding lug.

B. Provide across-the-line starter, non-recycling compressor overload, starter relay for each compressor. Provide manual reset current overload protection.

C. Minimum short circuit rating: 42,000 amperes rms symmetrical.

D. Provide starter relay for each condenser fan and motor with built-in overload protection.

E. Power block terminals shall be provided for different wire size connections. Wiring shall be numbered and color coded for ease of trouble-shooting.

F. Provide a surge capacitor and lightning arrestor in starter cabinet for protection from power surges due to lightning and switching transients.

G. Ground shall be #6 A.W.G. Provide separate driven ground for ground mounted and connect to building steel for roof mounted units.

H. Provide motor protector.

I. Provide separate power connection for power for evaporator heat tape.

J. Control Power Transformers: 120 volt secondary. 45 VA minimum. Provide fused primary, secondary, and bond unfused leg of secondary to enclosure.

K. Exposed compressor and fan motor power wiring shall be routed in liquid tight conduit.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Align chiller package on concrete foundation.

C. Connect to electrical service. Refer to Section 26 2717.

D. Connect to chilled water piping. Refer to Section 23 2113.

E. Arrange piping for easy dismantling to permit tube cleaning.

3.2 SYSTEM STARTUP

A. Supply initial charge of refrigerant and oil.

3.3 SCHEDULES

A. Refer to schedule on drawings.

END OF SECTION

SECTION 23 7313

MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufactured applied air handling units.

1.2 RELATED REQUIREMENTS

A. Section 23 0510 - General Mechanical Requirements.

B. Section 22 0513 - Common Motor Requirements for Plumbing Equipment.

C. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

D. Section 22 0719 - Plumbing Piping Insulation.

E. Section 22 1005 - Plumbing Piping: Equipment drains.

F. Section 23 2113 - Hydronic Piping.

G. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 1990 (Reapproved 2000).

B. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2001 (Reapproved 2007).

C. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2005.

D. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 2006.

E. ARI 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils; Air Conditioning and Refrigeration Institute; 2001 (R2002) .

F. ARI 430 - Standard for Central-Station Air-Handling Units; Air-Conditioning and Refrigeration Institute; 1999.

G. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

H. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory; Underwriters Laboratories Inc.; current edition.

I. UL 900 - Standard for Air Filter Units; Underwriters Laboratories Inc.; 2004.

1.4 SUBMITTALS

A. See Section 23 0510 - General Mechanical Requirements, for submittal procedures.

B. Product Data:
   1. Published Literature: Indicate dimensions, weights, capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.
   2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
   3. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
   4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.

5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

C. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

D. Manufacturer's Instructions: Include installation instructions.

E. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Dimensions of units shown on drawings are based upon the composite dimensions of the following manufacturers:

B. The Carrier Corporation; Model 39M.

C. The Trane Company; Model Modular Climate Changer.

D. York International, Inc.; Model Solution XTI.

2.2 GENERAL DESCRIPTION

A. Factory fabricated, applied, air handling units with components scheduled housed within modules for field assembly into an complete air handling system.

B. Configuration: Fabricate with fan and coil section plus scheduled sections and accessories, including:
1. Fan section.
2. Cooling coil section.
3. Electric Coil Section.
4. Filter section.
5. Service Access section
6. Mixing box section.

C. Fabrication: Conform to AMCA 99 and ARI 430.

D. Units shall be fabricated using post and frame construction and removable casing panels. Each section shall be capable of complete dis-assembly, including frame for entry into the existing building.

2.3 CASING

A. Construction: Fabricate each section of post frame capable of disassembly with removable panels or welded channel frame with removable panels, double wall construction with connection pieces for field assembly with gasketing between assembled sections.
1. Outside Casing:
a. G90 Galvanized Steel: 0.0516 inch, minimum.

2. Inside Casing:
   a. G90 Galvanized Steel: Solid, 0.0276 inch thick, minimum, unless noted otherwise.

B. Insulation: Neoprene coated, glass fiber, applied to internal surfaces with adhesive and weld pins with exposed edges of insulation coated with adhesive.
   1. "K" value at 75 degrees F: Maximum 0.26 Btuh/inch/sq ft/degrees F.
   2. Density: 2 inch thick, 3 lbs/cu ft.

C. Walk-in Access Doors: 18 x 40 inch, minimum, of galvanized steel insulated sandwich construction, for flush mounting, with hinges, gasket, latch, and handle assemblies. Provide on service side of each section of each air handling unit and on both sides of filter sections of units more than 4-feet in width. Provide 12 X 12 inch inspection window of 1/4 inch thick plexiglass at fan section when humidifier is mounted over drain pan.

D. Strength: Provide structure to brace casings for suction pressure of 6 inch wg positive and 4 inch wg negative, with maximum deflection of 1 in 200.

E. O.A. Intake Hood: Factory fabricated hood sized for the indicated airflow with factory finish matching unit. Provide hood with high performance moisture eliminator.

F. Factory Base Rail: Provide factory base rail of sufficient height to raise the unit condensate connections to provide height for trap as detailed on Drawings and routing of pipe to the floor drains indicated.

2.4 FANS

A. Type: Double width, double inlet centrifugal type fan(s), backward inclined, or Airfoil as scheduled.

B. Sound Ratings: AMCA 301; tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.

C. Bearings: Self-aligning, grease lubricated, ball or roller bearings with lubrication fittings extended to exterior of casing with plastic tube and grease fitting rigidly attached to casing.

D. Mounting: Locate fan and motor internally on welded steel base coated with corrosion resistant paint. Factory mount motor on slide rails. Provide access to motor, drive, and bearings through hinged access doors. Mount fan base on unhoused spring vibration isolators; refer to Section 22 0548.

E. Flexible Connection: Provide factory flexible connection to isolate fan from casing and adjacent sections.

2.5 BEARINGS AND DRIVES

A. Bearings: Heavy duty pillow block type, self-aligning, grease-lubricated ball bearings, with ABMA 9 L-50 life at 100,000 hours.

B. Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

C. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts, and keyed. Variable and adjustable pitch sheaves for motors 15 hp and under. Provide fixed sheave for 20 hp and over with matched belts. Provide second sheave during balancing so required rpm is obtained with sheaves set at mid-position. Provide drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

2.6 COILS

A. Casing: Provide access to both sides of coils. Enclose coils with headers and return bends fully contained within casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.Provide casing seals where pipe connections extend through casing.

B. Configuration: Row depth shall be a minimum of 6 rows. Drainable, with threaded plugs for drain and vent; threaded plugs in return bends and in headers opposite each tube.

C. Drain Pans:
1. Drain pan(s) shall be insulated double wall welded stainless steel , pitched for flow to drain connection, sloped in two planes.
2. Drain connection shall be dropped type to completely drain pan.
3. Pan design shall pass the requirements of ASHRAE Std. 62R.
4. Coils shall have drain pans under complete coil section. Extend pan , 8 inch minimum, downstream of coil and provide down spouts for cooling coil banks more than one coil high.
5. Provide a minimum of 1-inch from the bottom of the coil casing to the drain pan so the drain pan can be visually inspected and physically cleaned without bypassing airflow, including underneath the coil, without removal of the coil.
6. All drain pan connections shall be to the same side of the unit as the coil connections.

D. Coil Capacity: Certify capacities, pressure drops, and selection procedures in accordance with ARI 410.

E. Water coils: Water coils shall be provided with factory installed vent and drain piping with piping extended thru unit casing where coil header connections do not provide positive venting/draining thru piping connections. Coils shall not be provided with turbulators. Coil connections shall be on same side, unless shown otherwise on drawings. Stacked coils shall be in a vertical plane with section.

F. Fabrication:
1. Tubes: 1/2 or 5/8 inch ODOD 0.024 inch, minimum, seamless copper expanded into fins, brazed joints.
2. Fins: Aluminum,144 fins per foot, maximum.
3. Casing: Die formed channel frame of G90 galvanized steel

G. Water Cooling Coils:
1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
2. Tubes: 1/2 or 5/8 inch ODOD 0.024 inch, minimum, seamless copper expanded into fins, brazed joints.
3. Configuration: Row depth shall be a minimum of 6 rows. Drainable, with threaded plugs for drain and vent; threaded plugs in return bends and in headers opposite each tube.
4. Face Velocity: Cooling coil face velocity shall not exceed 500 feet per minute.

H. Electric Coils:
1. Assembly: UL listed and labeled, with terminal control box and hinged cover, splice box, coil, casing, and controls.
2. Coil: Enclosed copper tube, aluminum finned element.
3. Casing: Die formed channel frame of galvanized steel.
4. Controls: Automatic reset thermal cut-out, built-in magnetic contactors, SCR control circuit transformer and fuse.

2.7 FILTERS

A. Filter Box: Section with filter guides, access doors from both sides with latching handles, for side loading with gaskets, blank-off plates and casing access door(s).

B. Configuration: Flat.

C. Filter Media: UL 900 listed, Class I or Class II, approved by local authorities.

D. Flat: 2 inches deep disposable, extended area panel filters.

2.8 ACCESSORY SECTIONS

A. Access Service Section: Provide a full size, 24-inch long, insulated access section with walk-in style access doors on on service side of unit to provide service access to/ inspection of internal components.

2.9 DAMPERS

A. Damper Leakage: Maximum 2 percent at 4 inch wg differential pressure when sized for 2000 fpm face velocity.

2.10 LIGHTS

A. Each compartment shall be provided with lighting arranged for safety and servicing of unit.

B. Provide conduit and conductors for lights in accordance with Division 26 for a single point power connection.

C. Lighting fixtures shall be an enclosed and gasketed, vapor-tight, surface mounted fluorescent fixture with rustproof(fiberglass) housing and external lens clamps. Lens shall be patterned acrylic.

D. Fixture manufacturers: Daybrite VD Vaporlume, Lithonia DM Series, Miller KW Series, Metalux VT2 Series, Keystone Nautilus Series, Lumas V.T. Series, Voight, Midwest Sentinel II Series, Columbia LUN Series, H. E. Williams Series 86, Lightron Series 14, Legion 14 Series.

E. Provide 20 amp light switch at each compartment access door.

F. Surface mount light switch in type FS box with weather-proof cover.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Unit Bases:
1. Provide level housekeeping pad or base as indicated.
2. Construct housekeeping pad in accordance with Section 23 0510 , General Mechanical Requirements-Equipment Bases and Housekeeping Pads.
3. Pad thickness: 4 inches, minimum, unless noted otherwise on Drawings; when unit is provided with base, mounting legs or base rails that provide clearance for the condensate trap.
4. Increase pad height for unit furnished to provide space for condensate drain trap. Refer to trap detail on drawings.
5. Bolt units to pads.

C. Bolt sections together with gaskets.

D. Install flexible duct connections between fan inlet and discharge ductwork and air handling unit sections. Ensure that metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

E. Hydronic Coils:
1. Hydronic Coils: Connect water supply to leaving air side of coil (counterflow arrangement).
2. Provide shut-off valve on supply line and lockshield balancing valve with memory stop on return line.

3. Locate water supply at bottom of supply header and return water connection at top.
4. Provide manual air vents at high points complete with stop valve.
5. Ensure water coils are drainable and provide drain connection at low points.

F. Drain Pan: Route discharge from cooling coil drain pan to floor drain with drawn copper tube, full size of connection. Provide air seal trap(Refer to detail on drawings).

G. Electric Duct Coils: Wire in accordance with NFPA 70. Refer to Section 26 2717.

3.2 STARTING EQUIPMENT

A. Adjust for proper operation within manufacturer's published tolerances.

B. Demonstrate proper operation of equipment to the Owner 's designated representative.

3.3 SCHEDULES

A. Refer to schedule on Drawings.

END OF SECTION

SECTION 23 8101

TERMINAL HEAT TRANSFER UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Blower-coil Units.

B. Electric heaters.

1.2 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements for submittal procedures.

B. Product Data: Provide typical catalog of information including arrangements.

C. Refer to Submittals in Section 23 0510 for requirements regarding Tabulation of Power Wiring Requirements.

D. Manufacturer's Instructions: Indicate installation instructions and recommendations.

E. Operation and Maintenance Data: Include manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.3 QUALITY ASSURANCE

1.4 DELIVERY, STORAGE, AND PROTECTION

A. Refer to Section 23 0510 - General Mechanical Requirements for general delivery, storage and protection requirements.

B. Do not operate duct mounted equipment until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

PART 2 PRODUCTS

2.1 BLOWER COIL UNITS (BC)

A. Manufacturer:
   1. The Trane Company Model BCVB;York Model YSVW.
   2. Other Manufacturers: Carrier, McQuay, Magicaire.

B. General: Vertical upflow configuration complete with fan, cooling coil, filter rack, and disconnect switch.

C. Coils: Evenly spaced aluminum fins mechanically bonded to copper tubes, designed for 200 psi and 220 degrees F. Provide drain pan under cooling coil, easily removable for cleaning, with drain connection.

D. Casing: 0.0598 inch steel with exposed corners and edges rounded, easily removed panels, glass fiber insulation, filter, and integral air inlet and outlet..

E. Finish: Galvanized steel.

F. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, v-belt drive with adjustable sheave.

G. Motor: Factory mount motor on slide rails. Provide access to motor, drive, and bearings through hinged access doors.

H. Filter: Easily removed 1-inch thick glass fiber throw-away type mounted in rack with access door, located to filter air before coil section.

I. Maximum Unit Height: 60"

2.2 ELECTRIC DRAFT BARRIER HEATERS(EDB)

A. Manufacturer:
1. Qmark; Model DBA.
2. Other acceptable manufacturers offering equivalent products: Berko ASL, Markel 9100, Raywall 8100.

B. Assembly: UL listed and labeled with terminal box and cover, and built-in controls.

C. Heating Elements: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material.

D. Enclosure: Minimum 0.030 inch steel with 7 inch high back and top of one piece; front panel, end panel, end caps, corners, and joiner pieces to snap together, and front panel easily removable. Provide full length damper.

E. Control: Built-in bi-metal heating thermostat, factory wired.

F. Finish: To be selected by architect.

2.3 ELECTRIC UNIT HEATERS(EUH)

A. Manufacturers:
1. Berko; Model HUH.
2. Electromode; Model EUH.
3. INDEECO (Industrial Engineering and Equipment Company): www.indeeco.com.
4. Markel; Model 5100.
5. Marley Engineered Products; Model MUH: www.marleymeh.com.
6. Raywall; Model UH.

B. Assembly: UL listed and labeled assembly with terminal box and cover, and built-in controls.

C. Heating Elements: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material.

D. Cabinet: 0.0478 inch steel with easily removed front panel with integral air outlet and inlet grilles.

E. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

F. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard.

G. Motor: Permanently lubricated, sleeve bearings for horizontal models, ball bearings for vertical models.

H. Control: Separate fan speed switch and thermostat heat selector switch, factory wired, with switches built-in behind cover. Provide thermal overload.

I. Electrical Characteristics:
1. Refer to the power requirements indicated on the electrical drawings.

2.4 ELECTRIC CABINET HEATERS(ECH)

A. Manufacturers: Berko CUH, Electromode 'AA', Erincraft ECH, Markel 6300, QMark CU, Raywall 'T'.

B. Layout Basis: Markel 6300.

C. Assembly: UL listed and labeled assembly with terminal box and cover, and controls.

D. Heating Elements: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material.

E. Cabinet: 0.0598 inch steel with exposed corners and edges rounded, easily removed panels, glass fiber insulation and integral air outlet.

F. Finish: Factory applied baked enamel of color as selected on visible surfaces of enclosure or cabinet.

G. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

H. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard.

I. Motor: Tap wound multiple speed permanent split capacitor with permanently lubricated, sleeve bearings, resiliently mounted.

J. Filter: Easily removed 1 inch thick glass fiber throw-away type, located to filter air before heating elements.

K. Configuration:
   1. VWMEIU: Vertical, wall mounted, recessed, down flow unit with stamped vertical supply grille, stamped horizontal return grille, and remote mounted thermostat. Markel 6300.

L. Built-in Controls:
   1. Power disconnect switch.
   2. Automatic reset thermal overload protector.
   3. Tamper-proof bi-metal thermostat with 40-90 Degree F range adjustable through grille face.
   4. Fan Control: Multiple speed switch, factory wired, located in cabinet with integral fan delay switch.

M. Electrical Characteristics:
   1. Refer to the power requirements indicated on the electrical drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install terminal units in a readily accessible location.

C. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Do not damage equipment or finishes.

D. Baseboard Radiation: Locate on outside walls and run cover continuously wall-to-wall unless otherwise indicated. Center elements under windows. Where multiple windows occur over units, divide element into equal segments centered under each window. Install end caps where units butt against walls.

E. Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

F. Cabinet Unit Heaters: Install as indicated. Coordinate to assure correct recess size for recessed units.

G. Units with Cooling Coils: Connect drain pan to condensate drain.

H. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal.

I. Install electric heating equipment in accordance with Section 26 2717 .

3.2 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets to "like new" appearance, using finish materials furnished by manufacturer.

C. Install new filters.

3.3 SCHEDULES

A. Refer to Schedules on the Drawings.

END OF SECTION

SECTION 23 8130

DUCTLESS SPLIT SYSTEM AIR CONDITIONERS(DAC-* & DCU-*)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior Unit.

B. Exterior Unit.

C. Controls.

1.2 RELATED SECTIONS

A. Section 23 0513 - Motors for Mechanical Equipment: Evaporator and condenser fan motors.

B. Section 23 2300 - Refrigerant Piping and Specialties.

1.3 REFERENCES

A. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning and Refrigeration Institute; 1994.

B. ARI 270 - Sound Rating of Outdoor Unitary Equipment; Air-Conditioning and Refrigeration Institute; 1995.

C. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 1993 (and Revision 1,2,3,4).

D. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilation Systems; National Fire Protection Association; 1996.

1.4 PERFORMANCE REQUIREMENTS

A. Air entering exterior coil-summer: 95 degrees F.

B. Coordinate refrigerant pipe routing with the Contractor and provide equipment whose scheduled length limitation exceeds the refrigerant piping length requirements.

1.5 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements for submittal procedures.

B. Product Data: Provide data for manufactured products and assemblies. Indicate water, drain, thermostatic valves, and electrical rough-in connections with electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

D. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in the Owner's name and registered with manufacturer.

1.6 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide a five year warranty to include coverage for compressor including materials only.

1.7 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Provide one set of filters for each unit at the Final Observation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. The Carrier Corporation.

B. EMI.

C. Mitsubishi.

D. Sanyo.

2.2 AIR CONDITIONING UNITS

A. Description: Packaged, ductless split heat pump system consisting of interior and exterior units and controls.

2.3 INTERIOR UNIT

A. Cabinet
   1. Decorative cabinet with exposed corners and edges rounded, easily removed panels, glass fiber insulation and integral air outlet and inlet grilles.
   2. Finish: Factory apply baked enamel of color as selected on visible surfaces of enclosure or cabinet.
   3. Insulation: Minimum 1/2 inch thick acoustic duct liner for lining cabinet interior.
   4. Drain Pan: Galvanized steel with corrosion-resistant coating.

B. Evaporator fan
   1. Fan: Direct drive, double width, double inlet, forward curved centrifugal fan, statically and dynamically balanced, resiliently mounted.

C. Evaporator coil
   1. Direct expansion coiling coil of seamless copper tubes expanded into aluminum fins.
   2. Refrigeration circuit with fixed metering device(capillary tube) unless noted otherwise.

D. Auxiliary electric heat
   1. Assembly: UL listed and labelled assembly with steel frame and side mounted control cabinet and cover, and built-in controls.
   2. Heating Elements: Exposed helical coil of nickel-chrome resistance wire with refractory ceramic support bushings.
   3. Control Cabinet: 0.0478 inch steel with hinged front panel with latching disconnect switch.
   4. Built-in Controls: Disconnect in control panel face, mercury controlling contactors, manually resettable thermal cut-outs, 24 Volt control transformer, circuit fuses for heaters over 48 Amps, factory wired differential air-flow switch and terminal blocks.
   5. Disconnect Switch: Factory mount disconnect switch.

E. Air filters
   1. Filter: Easily removed 1 inch thick glass fiber throw-away type, located to filter air before coil.

2.4 EXTERIOR UNIT

A. Casing
   1. House components in welded steel frame with galvanized steel panels with weather resistant, baked enamel finish.
   2. Mount contactors and controls in weatherproof panel provided with full opening access doors.
   3. Provide removable access doors or panels with quick fasteners.

B. Compressor

1. Hermetically sealed, 3600 rpm maximum, resiliently mounted with positive lubrication and internal motor protection.
2. Compressor: Hermetic reciprocating type or Hermetic scroll type.

C. Condenser coils
1. Coils: Aluminum fins mechanically bonded to seamless copper tubing or all aluminum fins and tube. Air test under water to 425 psig, and vacuum dehydrate. Seal with holding charge of refrigerant.
2. Coil Guard: Louvered or PVC coat steel wire.

D. Fans and motors
1. Direct driven propeller type condenser fans with fan guard on discharge.
2. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor with permanent lubricated ball bearings and built in thermal overload protection.
3. Fan Guard: PVC coat steel wire .

E. Refrigerant circuit
1. For each refrigerant circuit, provide:
   a. Filter dryer liquid line.
   b. Suction accumulator.
   c. Suction and liquid line service valves and gage ports.
   d. Charging valve.
   e. Condenser pressure relief mechanism.
2. For heat pump units, provide reversing valve, suction line accumulator, flow control check valve, and solid-state defrost control utilizing thermistors.

F. Controls
1. Factory wired with single point power connection.
2. Factory wired controls shall include contactor, high and low pressure cutouts, internal winding thermostat for compressor, control circuit transformer, non-cycling reset relay.
3. Provide a surge capacitor and lightning arrestor in unit cabinet for protection from power surges due to lightning and switching transients.
4. Provide controls to permit operation down to 0 degrees F ambient temperature where scheduled to include:
   a. Crankcase heater with thermostat.
   b. Head pressure switch to cycle fan motors in response to refrigerant condensing pressure.
   c. Solid state control to vary speed of one condenser fan motor in response to refrigerant condensing pressure.

G. Additional heat pump controls
1. Low ambient thermostat to lock out compressor at low ambient temperatures.
2. An automatic defrost control shall be included to accomplish defrosting (only if coil saturated suction temperature indicates freezing temperatures) every 90 minutes for a period of not more than 10 minutes. Provide lockout to prevent auxiliary heat opening with heat pumps.

2.5 CONTROLS

A. Provide wall mounted room thermostat to control cooling with 'cool-off' selector switch and 'auto-on' fan control switch.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide level housekeeping pad or base as indicated.

C. Pipe refrigerant piping from interior unit to exterior unit; refer to section 23 2300.

D. Drain Pan: Route discharge from cooling coil drain pan to floor drain with drawn copper tube, full size of connection. Provide air seal trap(Refer to detail on drawings).

E. Electric Duct Coils: Wire in accordance with NFPA 70. Refer to Section 26 2717.

3.2 SCHEDULES

A. Capacities shall not be less than scheduled when matched together; 45 F minimum SST, 95 F ODT.

B. Refer to schedule on Drawings.

END OF SECTION

SECTION 23 8313

RADIANT-HEATING CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Heating cable.

1.2 RELATED REQUIREMENTS

A. Section 23 2300 - Identification for HVAC piping and equipment .

1.3 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements for submittal procedures.

B. Product Data: Provide data for heating cable and control components.

C. Manufacturer's Installation Instructions: Indicate installation instructions.

D. Maintenance Data: Include repair methods and parts list of components.

1.4 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by UL 778 as suitable for the purpose specified and indicated.

1.5 COORDINATION

A. Coordinate installation of heating cable with installation of piping, and piping insulation.

PART 2 PRODUCTS

2.1 FREEZE PROTECTION HEATING CABLE

A. Heating Cable: Self-limiting, parallel resistance heating cable.
   1. Manufacturers: Chromalox/Wieland Industrial Model SLR-8, Easyheat, Raychem, Thermon Manufacturing Company.
   2. Bus: Twin 16 AWG conductors.
   3. Core: Semiconductive polymer whose resistance varies with temperature extruded between bus.wires.
   4. Jacket: Flame retardant, water resistant thermoplastic material.
   5. Shield: Flexible tinned copper braid.
   6. Overcoat: Fluoropolymer jacket over braid.
   7. Setpoint: 40 degrees F.
   8. Accessories:
      a. End cap to seal cable.
      b. Power connection kit with molded weather proof junction box with terminal block.
      c. Splice/tee kit with molded weather proof junction box with terminal block.
   9. Rating: 120 V, 4 W/lineal ft.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping is ready to receive work.

B. Verify that required utilities are available, in proper location, and ready for use.

C. Beginning of installation means installer accepts conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install freezeprotection heating cable on condenser water pipes exposed outdoors.

C. Bending Radius: Six times cable diameter, minimum.

D. Avoid pinching and making sharp bends in cable.

E. Prevent damage by sharp rocks, metal, or other objects during installation.

F. Do not install heating cable across expansion or construction joints.

G. Do not cross heating cable over itself.

H. Fasten heating cable to pipe with cable ties 12 inch on center. Install with manufacturer's power connectors, splice kits and end seals.

I. Identify pipe after installation with pipe markers spaced 10 feet, maximum, on center, both sides of piping.

3.3 FIELD QUALITY CONTROL

A. Test continuity of heating cable.

B. Perform tests on completed cable installation. For cables embedded in concrete, perform tests immediately before and after concrete placement.

C. Measure voltage and current at each unit.

END OF SECTION

SECTION 26 0501

MINOR ELECTRICAL DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition.

PART 3 EXECUTION

2.1 EXAMINATION

A. Verify field measurements and circuiting arrangements.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to the Architect before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

2.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with Owner if building is to remain occupied during demolition.

C. Coordinate utility service outages with utility company.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Provide permanent modifications to existing circuits partially demolished in order to maintain continuity of service to existing devices or equipment remaining in operation. Match existing conductor and raceway sizes for extensions, splices ,etc required.
   2. Obtain written permission from the Owner at least 350_ hours before partially or completely disabling system.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify the Owner before partially or completely disabling system.
   2. Make notifications at least 48 hours in advance.
   3. Make temporary connections to maintain service in areas adjacent to work area.

F. Fire Alarm System: Where a required fire alarm system is out of order for more than 4 hours in a 24 hour period, the authority having jurisdiction shall be notified, and the building shall be evacuated or an approved fire watch shall be provided for all parties left unprotected by the shutdown until the fire alarm system has been returned to service.

G. Existing Telecommunications System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify the Owner at least 72 hours before partially or completely disabling system.
   2. Notify telephone utility company at least 24 hours before partially or completely disabling system.
   3. Make temporary connections to maintain service in areas adjacent to work area.

2.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

E. Disconnect and remove abandoned panelboards and distribution equipment.

F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

H. Repair adjacent construction and finishes damaged during demolition and extension work.

I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

2.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

END OF SECTION

SECTION 26 0510

GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Definitions

B. Quality Assurance Requirements and Installer Qualifications.

C. Submittal Procedures

D. Execution Requirements common to Division 26 systems

E. Equipment bases and housekeeping pads

1.2 DEFINITIONS

A. Manufacturers Representatives: Wherever MANUFACTURER'S REPRESENTATIVE is referred to in this division, said representative shall be regularly employed by the manufacturer to perform similar activities to those called for herein, which indicates his competence in that field of work.

B. Concealed: Where the word concealed is used in this Division, it shall mean items above ceilings, in attics, in crawl spaces, in chases, in tunnels, in cabinet work, and under counters or equipment so as to be not visible from an elevation of 5 feet at a horizontal distance of 10 feet.

C. Finished Spaces or Areas: Where finished spaces or areas are referred to in this Division, it shall mean all spaces except concealed spaces, mechanical rooms, or boiler rooms unless otherwise noted.

D. Provide: Where the word provide is used, it shall mean to furnish and install the item(s) in accordance with plans, specifications or manufacturer's instructions.

E. Control and Interlock Wiring: All wiring, both line voltage and low voltage, other than power wiring from an electrical distribution panel, through the primary control device, to the equipment.

F. Primary Control Device: That ONE device for any item of equipment which interrupts power flow during normal operation. Where magnetic starters are provided, they are the primary control. For items not switched by starters, the primary control device will be the ONE thermostat, manual switch, aquastat, P.E. switch, or relay performing the primary switching.

G. Diagrammatic: A drawing that shows arrangement and relations (as of parts).i.e: A diagrammatic drawing uses symbols rather than pictorial representation of pipes, ducts, conduit and other items shown and is not necessarily to scale. Arrangement, location, and sizes shown are firm.

H. Readily Accessible: Equipment, valves and other items requiring service shall be installed to be readily accessible. These items shall be available for maintenance or use in a space, through an access door from floor elevation, or above a lay-in ceiling by maintenance staff standing on a ladder no taller than the ceiling.

I. Noted, Indicated or Shown: Where the terms "Noted", "Indicated" or "Shown" are used in these specifications, the words "in the specifications or on the plans" shall be inferred.

J. Detail: Details referenced shall pertain to plans unless otherwise noted.

K. Specifications: Where reference is made to these specifications, it shall be inferred in this Division of specifications.

L. Notification by the Contractor, and Instructions to the Contractor: Where reference is made in these specifications to notification by or instructions given to the Contractor, it shall be inferred that the Architect shall be the notifier or the instructor as the case exists.

M. Submittal Data, Equipment Cuts, Shop Drawings: Wherever these terms are used in the plans or specifications, the information is to be submitted for review as part of the packaged submittal specified under "SUBMITTALS".

N. Conduit of Duct Bank: Two or more, 2-inch or larger conduits with a common point of origin and a common point of termination routed parallel, and as specifically designated on plans.

O. See Article 100 of the 2008 National Electrical Code with 2009 Georgia State Amendments.

P. Division or Section Reference: Where reference is made to another Division or Section within this Division, refer to specifications table of contents for Division, Section, or Page Number.

Q. Diagrammatic: A drawing that shows arrangement and relations (as of parts). A diagrammatic drawing uses symbols rather than pictorial representation of pipes, ducts, conduit and other items shown and are not necessarily to scale. Arrangement, location and sizes shown are firm.

1.3 REGULATORY REQUIREMENTS

A. General: Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.

B. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.

C. Jurisdiction: Where codes or guides refer jurisdiction to local governing code officials, such official in this procedure shall be the State Fire Marshal.

D. Permits: Permits and licenses of a temporary nature necessary for the prosecution of the work shall be obtained and paid for by the Contractor. Neither the Contractor nor any sub-contractor will be required to pay Municipal or County building permit fees. The Contractor and/or any subcontractor will be required to pay any Municipal and/or County building license taxes or fees, if any.

E. Energy: Conform to the International Energy Conservation Code, 2006 Edition, with 2008 and 2009 Georgia State Amendments.

F. All Work: Conform to State of Georgia Chapter 120-3-3 "Rules of Safety Fire Commissioner, Rules and Regulations, February 1, 2007", and the American Disabilities Act (ADA), January 26, 1992.

G. Fire Prevention: Conform to Georgia State Minimum Standard Fire Prevention Code (International Fire Code), 2006 Edition, with 2007 Georgia State Amendments.

H. Building Code: Conform to the Georgia State Minimum Standard Building Code (International Building Code), 2006 Edition with 2007 & 2009 Amendments.

I. Electrical: Conform to the 2008 National Electrical Code (NEC) with 2009 Georgia State Amendments, NFPA, and the National Electrical Safety Code.

1.4 PERFORMANCE REQUIREMENTS

A. Requirements specified herein are minimum. All equipment, when installed, shall perform equal to or exceed specified requirements.

.5 VALUE ENGINEERING

A. Where the Contractor is requested to offer or make Value Engineering suggestions as a means of reducing the Project Cost, the Contractor shall present suggestion in the format prescribed herein.

B. Provide each suggestion in writing referencing the specific element involved, ie. specification article and/or drawing/detail number(s).

C. State how the proposed change impacts the project, ie. change in life expectancy, increased operating costs, etc. in addition to the reduction of first cost (Amount of cost reduction.).

D. State how the change will impact the Construction Schedule.

E. Where the change impacts the contract drawing(s), provide a sketch of the proposed change to assist in the evaluation process. If the suggestion is approved, the Contractor shall provide a drawing, as a part of the shop drawing process, showing the Contractor's proposed changes.

F. Each suggestion shall include specific language commenting that the proposed change has been or has not been successfully made previously on one or more similar projects.

1.6 SUBMITTALS

A. Supplementing Division 1 requirements; the Contractor shall:
   1. Review the submittal data and check to ensure compliance with specifications prior to submitting.
      a. The Contractor agrees that submittals of equipment and material and shop drawings of equipment and material layouts required under provisions of these specifications and processed by the are not Change Orders.
      b. The purpose of submittals is to demonstrate that the Contractor understands the design concept of the project by indicating the equipment and materials he intends to furnish and install, and by detailing the installation he intends to achieve. The review by the Architect shall NOT be construed to be for the purpose of "approving" equipment or drawings.
      c. The Contractor shall conform to the requirements of the Contract Documents unless a change order or a specific letter of clarification is issued. The Contractor shall identify on each submittal and in letter form to the Architect any and all deviations from the Contract Documents.
      d. Any submittal or shop drawing not conforming to the Contract Documents without this identification and notification shall be assumed to be marked "Revise and Resubmit" (the Contractor acknowledges this by the submission), and the Contractor shall promptly resubmit said submittal so as to be in full compliance with the Contract Documents.
      e. Failure of the Contractor to provide this information during the shop drawing phase shall make the Contractor responsible for all changes to achieve compliance with the Contract Documents without additional compensation.
   2. Assemble the submittal data in compete sets in hard back three-ring binders, separated by trade, (Electrical and Telecommunications), and bound with numbered index sheets and tabs. Submittal data shall be submitted at one time unless unavailable data such as control submittal would delay project progress. Submittal data for Fire Alarm System, and Telecommunications System shall include the following:
      a. Devices and panels data sheets.
      b. Typical devices wiring diagrams.
      c. Plans showing devices, zone of each device, & interconnecting conductor/conduit.
      d. System operation description.

3. Identify all submittals by a cover sheet showing project name, specification sections, drawing or detail number, room number, date, revision date, the Contractor and subcontractor's organization and project manager with phone number, the model, style and size of item being submitted with manufacturers' representative, salesman (or a preparer who can answer questions), and preparer's phone number.
4. Manufacturers' standard drawings shall be modified by deletions or additions to show only items applicable to this project.
5. Prepare a master list of submittals proposed to be submitted on the project. This list shall be updated for each submission and shall be the first sheet(s) of the submission in the quantity that is submitted for review. The information and general format shall contain an Tab number, Item Description, Item Status and any comment.
6. Provide a Letter stating that all submittals have been checked for compliance with specifications.

B. Power Wiring Requirements: The Contractor shall submit a letter acknowledging receipt and review of the Tabulated List of Power Wiring Requirements of all Mechanical Equipment specified in Division 23 of the Specifications. Failure to submit this letter will require the Contractor to assume responsibility for any required changes to the electrical design attributed to mechanical equipment. Include a copy of the Tabulated List of Power Wiring Requirements with the letter. The electrical requirements for the mechanical equipment is based on the best information available at the time of design. The Contractor is responsible for coordinating with the purchased equipment.

C. Service Voltage Verification: The Contractor shall provide a letter verifying the availability of indicated service voltage from the serving utility company. The letter shall be included in the submittal data. No electrical equipment shall be released for fabrication until such verification has been made.

D. Certificates:
1. For Fire Alarm System: Start-up, testing and placing into operation shall be performed by the field representatives of the manufacturers.
2. Certificates of the manufacturers shall be provided on the letter heads of the manufacturers in which the manufacturer certifies that the equipment has been installed in strict compliance with the manufacturers recommendations and is operating properly.
3. The manufacturers shall list in the certificate the item or items furnished to the job.
4. The Contractor shall coordinate performance of the aforesaid services and shall, in all cases where the equipment of two or more manufacturers tie in and function together, require the field representatives to perform simultaneously the initial start-up, the testing, and the placing of their equipment into operation. Start-up is defined as putting the equipment into action. Testing is defined as performing such testing as is stipulated in the contract documents to be performed. Placing into operation is defined as operating the equipment for a sufficient period of time for the determination to be made that it is performing properly.
5. Notification shall be given at least 48 hours in advance of start-up. The Contractor shall give each system supplier the advance notice time he requests for his work on his system.

1.7 OPERATING AND MAINTENANCE MANUALS

A. Each Manual shall be compiled as follows:
1. Data shall be bound in smooth surface hard back commercial quality three-ring notebooks with project identification shown on the front cover and binding back. Identification labels shall be typed and adhered with waterproof glue.
2. Notebooks shall have 9-1/2-inch by 11-1/2-inch covers with back width to permit the covers to lie parallel or to converge, and have not less than 1-1/2-inch back width.
3. Index divider sheets of heavy Manila paper shall be inserted between each section of the Manual with a 2-inch x 1/3-inch ready-cut shield tab attached to each sheet for identification of sections.

4. Data sheets and diagrams shall be 8-1/2-inch x 11-inch or be mounted on 8-1/2-inch x 11-inch sheets of 16-pound paper if smaller, with reinforced 11-inch mechanically perforated edges. Drawings and diagrams larger than 8-1/2-inch by 11-inch shall be folded up from the bottom to form a height of 11-inches and folded to the left to form a width of 8-1/2-inches.
5. Table of Contents(Index) sheets shall be provided in the order listed with identifications typed in capital letters.

B. Each Manual shall contain the following information, data and drawings:
1. Copies of approved submittals (with Engineer's review comments and stamp), equipment and materials.
2. Manufacturer's installation, operating and maintenance instructions for each item of equipment.
3. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.
4. Control diagrams.
5. Copies of shop drawings showing layouts and construction details.

1.8 QUALITY ASSURANCE

A. Electrical Installer's Qualifications:
1. General: Wherever the word "Sub-Contractor" or "Firm" is used in these subparagraphs, it shall mean the Contractor/sub-contractor of record for the installations used for proficiency qualification.
2. Warranty of Contractor: The Contractor shall warrant that the Firm(s) selected by him are reputable, skilled, reliable, competent, qualified in the trade or field in which they are to perform on the project, and thoroughly familiar with applicable codes and standards.
3. Location: The firm which performs the installation of the work under this section shall be one who maintains an established, experienced organization with a permanent, manned office.
4. Experience: The firm's proficiency in the installation and adjustment of Electrical systems shall have been demonstrated by the successful performance of work as specified herein on at least three commercial, hospital or institutional buildings with a minimum floor area of 20,000 square feet, 480 volt, 1200 amps, 3 phase service entrance.
5. The firm shall have been in business performing services as specified herein for at least 3 years.

B. Activity Log Book:
1. A Log Notebook of tear-out sheet type, with consecutively numbered pages shall be maintained on site by the Project Superintendent providing a continuous record of tests, equipment start-up, system start-up/check out for the length of the project.
2. Notebook entries shall include data; description of test/check out; sub-contractor involved; personnel involved; and results.
3. The Contractor shall turn over original notebook and two (2) first generation copies to the Architect at final inspection.

C. Substitutions:
1. All costs incurred by acceptance of substitutions shall be borne by the Contractor. Should any proposed substitute equipment require services in addition to or in excess of services provided in the Contract Documents, these services shall be provided at no extra cost to the Owner.
2. Request for approval of a proposed product (substitution) shall be accompanied by the schedule setting forth in which respects the materials or equipment submitted for consideration differ from the materials or equipment designated in the Contract Documents and from the design intent. If there are no deviations or changes required to the design, the submittal shall be accompanied by the following statement: "The proposed material or equipment submitted for approval requires no changes to the Contract Documents to

achieve the design intent." Lack of the schedule or statement will result in automatic disapproval of the request.

3. Facsimile (Fax) Requests for prior approval will not be considered due to the inability of the sender being able to assure that information sent was information received and possible poor clarity of the fax, and the short time period for review and response.

D. Architectural And/Or Structural Requirements:
   1. Refer to the specifications and Architectural and Structural drawings for additional requirements pertaining to work under this discipline. Notify the Architect if conflict for clarification.

1.9 WARRANTY

A. See General Conditions.

B. Where extended warranties beyond the Contractor's one (1) year warranty are specified, the additional warranty time shall start at the end of the Contractor's warranty.

C. Correct defective Work within a one year period after Date of Substantial Completion.

1.10 NOTIFICATION TO THE OWNER WHEN THE CONTRACTOR VISITS SITE AFTER FINAL INSPECTION

A. When the Contractor's representative visits the job after the final inspection to perform specific work such as maintenance service, seasonal balance, or to correct a deficiency, the Contractor shall notify the Owner not less than 48 hours prior to the date on which they will visit the site, except under an emergency condition.

B. The Contractor shall visit the designated office of the Owner to notify the Owner that the Contractor is on the site prior to visiting the site, thereby enabling the Owner's representative to accompany the Contractor, should they so desire while the Contractor is on the project site.

C. A carbon copy of the notification shall be provided to the Architect with the intent of the site visit. After the Contractor has completed the site visit, the Contractor shall give a written report of the action taken and any incomplete work yet to be performed to the Architect, within five (5) days.

1.11 ABBREVIATIONS - ELECTRICAL

AIC	AVAILABLE INTERRUPTING CAPACITY
A.F.F.	ABOVE FINISHED FLOOR
AL	ALUMINUM
ANT	ANTENNA
AWG	AMERICAN WIRE GAUGE
B.E.	BOTTOM ELEVATION
B.G.	BELOW FINISHED GRADE
BRKR	BREAKER
C	CONDUIT
CAT.	CATALOG
C.H.	CEILING HEIGHT
CLG	CEILING
C.O.	CONVENIENCE OUTLET
COND.	CONDUCTOR(S)

CR	CONTROL RELAY
CU	COPPER
D.	DIAMETER
EMER	EMERGENCY
EMT	ELECTRICAL METALLIC TUBING
F.O.	FIBER OPTIC
FAP	FIRE ALARM PANEL
FUT	FUTURE
GND	GROUND
H-O-A	HAND-OFF-AUTO
HPS	HIGH PRESSURE SODIUM
HTR	HEATER
I.A.W.	IN ACCORDANCE WITH
I.C.	INTERCOM MASTER STATION
IMC	INTERMEDIATE METALLIC CONDUIT
MB	MAIN BREAKER
M.C.	MASTER CLOCK
MFGR	MANUFACTURER
MLO	MAIN LUGS ONLY
MTD	MOUNTED
MTG	MOUNTING
MV	MERCURY VAPOR
N.E.C.	NATIONAL ELECTRICAL CODE (2002)
NFDS	NON FUSED DISCONNECT SWITCH
N.I.C.	NOT IN CONTRACT
NMC	NON METALLIC CONDUIT
NO.	NUMBER
PB	PUSHBUTTON
PLCS	PLACES
PVC	POLYVINYL CHLORIDE
R.	RADIUS
R.G.S.	RIGID STEEL CONDUIT
SCHED.	SCHEDULE
SEC.	SECTION
SMR	SURFACE METAL RACEWAY

SURF.	SURFACE
SYM	SYMMETRICAL
TEL.	TELEPHONE
TR	TIME RELAY
TYP.	TYPICAL
W/	WITH
WP	WEATHERPROOF
XFMR	TRANSFORMER
20A/3P	20 AMP / 3 POLE TYPICAL

PART 3 EXECUTION

2.1 EXAMINATION

A. Hazardous Materials:
   1. A/E's Responsibility: Plans and specifications have been prepared by the A/E for the Owner without the A/E having conducted investigation as to the presence of asbestos or hazardous waste on the project. Not being a part of this contract, the A/E has not charged any fees and has not and will not advise the Owner with regard to the detection and/or removal of asbestos or hazardous waste. The Owner is aware that asbestos or hazardous waste could be present and will make all decisions with regard to its removal. The removal of all hazardous materials and encapsulation of remaining surfaces is the sole responsibility of the Owner.
   2. If the Contractor observes the existence of a friable material which must be disturbed during the course of his work, the Contractor shall promptly notify the Owner and the Architect. The Owner shall make all arrangements regarding testing and removal or encapsulation of asbestos material if present. The Contractor shall not perform any work pertinent to the friable material prior to receipt of special instructions from the Owner through the Architect.
   3. "Friable Material" is any material which can be crumbled, pulverized or reduced to a powder by hand pressure when dry.

B. Asbestos (ACBM)
   1. Specifications written for equipment and materials in this division of the specifications are intended to eliminate any asbestos containing substance. The Contractor and his suppliers are hereby notified that NO ASBESTOS CONTAINING PRODUCT IS PERMITTED. If a product is listed in these specifications which contains asbestos, the Contractor and his supplier shall so inform the Architect immediately and shall not deliver such product to the project site until additional written instructions are received.
   2. Upon completion of construction, and prior to final inspection, the Contractor for work performed under this division of the specifications shall be required to provide a certificate to the Architect in the following form:

CERTIFICATION FOR ASBESTOS CONTAINMENT

I/we _____(Sub-Contractor), certify that there is no asbestos contained in materials provided and/or installed by us in_____
_____(Project/Building).

WITNESS _____(Notary Public)
DATE:_____

CONTRACTOR:_____

_____

BY:

_____

TITLE:

_____

C. Refer to the specifications and Architectural and Structural drawings for additional requirements pertaining to work under this discipline. Notify the Architect for clarification in the event of conflict.

2.2 PREPARATION

A. Drawings are diagrammatic and show the general location of the equipment, raceway, and equipment, but are not to be scaled. All dimensions shall be verified at the building site. Prefabrication and/or installation of work from drawings shall be at the Contractor's risk. Refer to Architectural plans for exact building dimensions and details.

B. Space Conditions:
   1. All apparatus shall fit into the available spaces in the building and must be introduced into the building so as not to cause damage to the structure. Equipment larger than access to equipment spaces shall be disassembled into sub-assemblies for installation.
   2. Where deviations from the plans are required in order to conform to the space limitations, such changes shall be made at no additional cost to the Owner and shall be subject to approval.
   3. All equipment requiring service shall be made accessible.

C. Where new work is specified or shown connected to old work and materials are different from existing, the Contractor shall request a clarification from the Architect prior to performing the work.

D. The demolition plan has been prepared to assist the Contractor in determining the scope of demolition work and should not be construed to be all of the demolition required. The Contractor shall visit job site (after carefully reviewing the contract documents) and determine exact areas and quantities of existing materials to be removed to accomplish new construction.

2.3 INSTALLATION

A. Indoor Air Quality Environment: Portions of the existing building will be in use and occupied during construction. The Contractor shall schedule work and provide temporary ventilation and/or isolation to insure that fumes from welding, other construction tasks, and out-gassing from construction materials do not migrate to occupied areas.

B. All equipment shall be installed in accordance with manufacturer's published installation instructions shipped with the equipment. In the event there is a discrepancy between these specifications or Drawings and the manufacturer's instructions, no work shall be performed until additional instructions are received.

C. Route conduits and cable trays to avoid skylights, translucent, and transparent ceilings.

D. Cutting and patching in connection with the installation shall be done by the trade whose work is to be cut. The Contractor shall lay out and install his work ahead of the work of other trades wherever possible.

E. Where penetrations are made in fire rated partitions, walls, floors or ceilings during the course of electrical installation, these penetrations shall be restored to their intended fire ratings by the use of fittings or materials as approved by Underwriter's Laboratories for this purpose.

F. Fire Prevention Precautions in Cutting and Welding Areas: Conform to Article 2904 Fire Prevention Precautions, Georgia State Minimum Standard Fire Prevention Code (International Fire Code), 2006 Edition, with 2007 Georgia State Amendments for all work involving cutting and welding.

G. Seal sleeves and openings in exterior walls, mechanical room walls, fire rated partitions, floors above grade, and partitions around humidity controlled spaces vaportight, watertight, or for smoke/fire protection as applicable. Refer to Section 07 8400 - Firestopping.

H. Refer to Section 07 9000.

I. Record Drawings:
   1. After completion, any changes in the location of conduits, the connections of circuits, or any other changes from the contract documents shall be noted on a clean set of blue line white prints and delivered to the Architect before final acceptance of work.

2.4 INTERFACE WITH OTHER WORK

A. General: No roughing shall be done until roughing drawings and exact electrical demand of equipment is obtained. Notify the Architect of any discrepancies.

B. Mechanical:
   1. Review Tabulated List of Power Wiring Requirements of all Mechanical Equipment specified in Division 23 of the specifications. Conduit, conductor and breaker sizes shown for mechanical equipment are based upon the best available information on the equipment specified. The Contractor shall be allowed to provide electrical circuits compatible with the proposed mechanical equipment where the mechanical equipment conforms to Division 26 of the specifications, but does not conform to the electrical criteria of these contract documents. The Contractor shall submit the proposed electrical modifications to the Architect for review prior to roughing. No additional costs to the contract will be allowed for these modifications.
   2. Provide control, program and interlock wiring as shown on Mechanical and/or Electrical drawings.
   3. Provide conduit, wiring, boxes, adaptors for equipment terminations and disconnect switches. Provide power wiring through primary control device.
   4. Starters, push-button stations, contactors, relays, limit and safety devices, and control items are specified in Division 26 of the specifications (except as shown in Motor Control Center). Unless otherwise noted, all starters shall be mounted between 24" and 80" above finished floor. Push-button stations shall be mounted at switch height except as noted.

5. Kitchen Equipment, Laboratory Equipment, and Shop Equipment: Make electrical connections to all equipment provided under this contract from outlets shown. Obtain roughing drawings prior to installing any outlets. Notify the Architect of any discrepancies between roughing drawings and contract documents. The Contractor shall be allowed to provide electrical circuits compatible with equipment acceptable to the Architect but not conforming to electrical criteria of these contract documents, but the Contractor shall submit proposed electrical modifications to the Architect prior to roughing. No additional costs to the contract will be allowed for these changes.
6. Kitchen Equipment and Laundry Equipment: Review tabulated sheet of Power Wiring Requirements of all kitchen, and laundry equipment specified in Division 26 of the specifications. Conduit, conductor, and breaker sizes shown for the equipment are based upon the best available information on the equipment specified. The Contractor shall be allowed to provide electrical branch circuits compatible with the kitchen, and laundry equipment acceptable to the Architect, but not conforming to the electrical criteria of these contract documents. The Contractor shall submit the proposed electrical modifications to the Architect for review prior to roughing. No additional costs to the contract will be allowed for these changes.
7. Owner Furnished Equipment: Provide conduit, wiring, boxes, adaptors for equipment terminations, and disconnect switches. Make all connections indicated.
8. The information shown on the plans is based upon the best available information. Before performing any work on the site, the Contractor shall contact the utility company(s) serving the facility and stake out all underground services. Notify the Architect of any discrepancies.

C. Laboratory Equipment Purchased by the Owner, Installed by the Contractor:
1. Equipment planning, design, and layout is specialized, proprietary and coordinated with exact floor plan, structure, building systems, and finishes. Therefore the equipment supplier is responsible for providing detailed installation drawings including, but not limited to, drawings showing complete details on utilities and their routing. Revisions to these drawings are the responsibility of the supplier. The supplier shall provide notice of revisions to the Owner, the Architect and the Contractor prior to the Contractor's scheduled commencement of construction of this work.
2. Since the Owner is purchasing the equipment, the Contractor shall coordinate with the Owner to procure documents and to procure construction assistance from the equipment supplier regarding their system prior to any fabrication or installation work.
3. The Contractor shall coordinate with the equipment supplier through the Owner concerning proposed revision of equipment supplier design or comments to accommodate site conditions. The Contractor shall not revise equipment supplier design.
4. The equipment supplier shall review the contract documents for compatibility of interface with the system(s) being furnished and provide comments to the Architect and the Contractor. The Contractor shall provide information such as shop drawings and material cuts to the equipment supplier for coordination review and comments.
5. Equipment drawings, by this reference, shall be incorporated into the contract documents. Equipment drawings shall be the latest Owner approved set at time of bidding.

D. Site Utilities: The information shown on the plans is based upon the best information available. Before performing any work on the site, the Contractor shall contact the utility company(s) serving the facility and stake out all underground services. Notify the Architect of any discrepancies.

2.5 EQUIPMENT BASES AND HOUSEKEEPING PADS

A. Provide housekeeping and equipment bases as shown or listed below. Rough up slab under bases before pouring concrete.

B. Materials: Refer to Section 03 3000 - Cast-in-Place Concrete. Omit test cylinders for concrete poured under this section.

C. Bases/Pads shall be rectangular with vertical sides 4 inches from centerline of anchor bolts or 2 inches from edges of equipment supports, whichever provides the larger dimension, side of equipment or base edge, unless otherwise noted. Housekeeping pads shall be minimum 4 inches thick.

D. Chamfer: 3/4 inch on edges and corners.

E. Reinforcing: 6"x 6" 10/10 WWF at mid-depth of slab. (4 inch thick pads.)

2.6 STARTING EQUIPMENT AND SYSTEMS

A. Adjust equipment for proper operation within manufacturers' published tolerances.

B. Demonstrate proper operation of systems and equipment to the Owner 's designated representative.

2.7 DEMONSTRATION, TRAINING AND INSTRUCTIONS

A. Instructions:
1. Instruct operating personnel designated by the Owner in operation and maintenance of systems prior to the request for final inspection. A manufacturer's service representative shall provide the instructions for each piece of equipment on system. A manufacturer's sales representative is not acceptable. (Instructor shall not be a sales person, but shall be one with service experience on a continuing basis, knowledgeable about the subject equipment.) The Owner will record (audio or video/audio) operating instructions given by the contractor to the operating personnel.
2. The Contractor shall give notice to the Architect not less than 60 days of the anticipated date of instruction to allow planning by the Owner.
3. The Contractor shall request the instruction date not less than 15 days of the desired date for coordination with the Owner. Operating manuals for the equipment/systems on which instructions are being given shall be in the possession of the operating personnel not less than 30 days prior to the date of instruction.
4. The Contractor shall give an orientation session to operating personnel for achieving familiarity (not instructions) of the systems approximately 5 days prior to the instruction date. The Contractor's representative giving instruction shall be knowledgeable in the equipment/systems to allow quality recordings by the Owner.
5. Provide a signed statement from operating personnel certifying orientation and instructions have been received. Provide typed sequence of operation to be inserted in the maintenance manuals.

B. Completion of Work:
1. At material completion a test shall be made and the entire system shall be shown to be in working condition. The following shall be made available to personnel conducting the test:
   a. Electrician with hand tools.
   b. Accurate Voltmeter.
   c. Clamp on Ammeter.
   d. Test Lamp.
   e. Phase Rotation Indicator.
   f. Complete Electrical Specifications and Drawings with all addenda and revisions.
   g. Pre-final Punch List indicating disposition of all items with initials of person confirming completion.
2. The Contractor shall demonstrate proper operation of the Fire Alarm System. Refer to Section 28 3100 - Fire Alarm System for performance testing requirements.
3. At Material Completion, the Contractor shall present the following to the Architect:
   a. Finalized and corrected maintenance manuals.
   b. Special systems certificates.
   c. Record marked-up drawings.
   d. Required test results.

2.8 CLEANING and PROTECTION

A. All materials, equipment and electrical/telecommunications rooms shall be cleaned prior to Material Completion.

B. Remove any stored materials. Vacuum interiors of all panelboards, switchboards, switchgear, transformers and any other electrical equipment.

C. Paint equipment where finish has been damaged requiring retouching of finish to match factory finish. Equipment which has been damaged beyond the point of retouching or has been retouched not to match shall be repainted to match factory finish.

D. Chipped or scraped paint shall be retouched to match original finish.

E. All equipment shall be free of dust, rust and stains prior to material completion.

F. During Construction: Conduit openings shall be closed with caps or plugs. All equipment shall be covered and protected against water, dirt and chemical or mechanical injury. All equipment and material shall be stored in accordance with manufacturer's recommendations.

2.9 FINISHING ELECTRICAL EQUIPMENT AND MATERIAL

A. Use paint systems specified in Division 9 for the substrates to be finished.

B. Paint conduit and electrical equipment in exposed, public areas per the Architect's instructions.

C. All ferrous fasteners and hanger supports not having a corrosion resistant plated finish shall be painted to prevent rust.

D. Paint all equipment, including that which is factory-finished, exposed to weather or to view on the roof and outdoors.

END OF SECTION

SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 V AND LESS)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wire and cable for 600 volts and less.

B. Wiring connectors and connections.

1.2 RELATED REQUIREMENTS

A. Section 26 0573 - Electrical Testing.

B. Section 26 0553 - Identification for Electrical Systems.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide for each cable assembly type.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 WIRING REQUIREMENTS

A. Concealed Dry Interior Locations: Use only building wire with Type THHN/THWN insulation in raceway.

B. Exposed Dry Interior Locations: Use only building wire with Type THHN/THWN_ insulation in raceway.

C. Above Accessible Ceilings: Use only building wire with Type THHN/THWN insulation in raceway.

D. Wet or Damp Interior Locations: Use only building wire with Type THHN/THWN insulation in raceway.

E. Exterior Locations: Use only building wire with Type XHHW insulation in raceway.

F. Under or In Slab on Grade Installations: Use only building wire with Type XHHW insulation in raceway.

G. For In Slab Above Grade Installations: Use only building wire with Type THHN/THWN insulation in raceway.

H. Use solid conductor for feeder and branch circuits #10AWG and smaller.

I. Use stranded conductor for for feeder and branch circuits #8 AWG and larger.

J. Use stranded conductors for control circuits.

K. Use conductor not smaller than 12 AWG for power and lighting circuits.

L. Use conductor not smaller than 16 AWG for control circuits.

M. Conductor sizes are based on copper unless indicated as aluminum or "AL".

2.2 WIRE MANUFACTURERS

2.3 BUILDING WIRE

A. Manufacturers: conductors shall be manufactured in the USA.

B. Conductor: Copper.
1. Provide copper conductor. No aluminum conductor shall be allowed.
2. Provide copper conductor to chillers; aluminum conductor shall NOT be allowed to serve chillers.

C. Insulation Voltage Rating: 600 volts.

D. Insulation: NFPA 70.
1. Dry location Feeders and Branch Circuits sized #8 AWG and smaller: Type THHN/THWN.
2. Dry location Feeders and Branch Circuits sized #6 AWG and larger: Type THHN/THWN or THW.
3. Damp or wet location feeders and branch circuits, all sizes: XHHW

2.4 WIRING CONNECTORS

A. Solderless Pressure Connectors: Use solderless pressure connectors with insulating covers for copper conductor splices and taps, #10 AWG and smaller.

B. Insulated Spring Wire Connectors: Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, #10 AWG and smaller.

C. Compression Connectors: Use for conductors #8 AWG and larger. Compression/crimp-on connectors are approved for all applications where available.
1. Product: Anderson Versa-Crimp, Burndy Hydent, T&B Color-Keyed

2.5 LACING AND LUBRICANTS

A. Lacing: wiring in cabinets, panels, pullboxes, junction boxes and electrical gear shall be laced and held with one of the following:
1. T&B Ty-Raps
2. Fastway Wire Ties
3. Burndy Uni Raps

B. Lubricants: Electro Y-ER-EAS, Ideal Yellow 77, or Minerallac #100.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire and cable has been completed.

C. Verify that raceway installation is complete and supported.

D. Verify that field measurements are as indicated.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

B. Verify that interior of building has been protected from weather.

3.3 INSTALLATION

A. Install wire and cable securely, in a neat and workmanlike manner, as specified in NECA-1.

B. Route wire and cable as required to meet project conditions.
   1. Wire and cable routing indicated is approximate unless dimensioned.
   2. Include circuit of lengths required to install connected devices within 10 ft of location shown.

C. Use wiring methods indicated.

D. Use suitable wire pulling lubricant for building wire #4 AWG and larger, and for smaller sizes where require to pull without conductor damage. Manufacturers include but are not limited to Electro Y-ER-EAS, Ideal Yellow 77, Minerallac #100, or Polywater.

E. Pull all conductors into raceway at the same time.

F. Do not pull wires until conduit system is complete.

G. Raceway shall be continuous.

H. Terminations and Equipment Connections: compression fittings shall be installed with the manufacturer's recommended procedures and tools. Mechanical connections shall be torqued utilizing the manufacturer's published torque requirements utilizing tools indicating torque values for the device being tightened.

I. Use suitable wire pulling lubricant for building wire #4 AWG and larger.

J. Protect exposed cable from damage.

K. All splices, taps and joints in exterior circuits shall be waterproofed by use of UL listed kits.

L. Use suitable cable fittings and connectors.

M. Neatly train and lace wiring inside boxes, equipment, and panelboards.

N. All branch circuits (lighting and power) shall have a dedicated Neutral conductor. Shared neutral conductors shall not be allowed.

O. Conductors shall be continuous and unspliced between junction boxes, panels, or equipment terminations.

P. Provide manufacturer's compatible fittings meeting U.L. at boxes.

3.4 SPLICES, TAPS, TERMINATIONS

A. Clean conductor surfaces before installing lugs and connectors.

B. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

C. Conductors #6 AWG and larger: provide Terminal Lugs. Anderson Versa-Crimp, Burndy Hydent or T & B Color-Keyed.

D. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

E. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
   1. Use Hi Bakelite wire connectors, 3M Skotchloks or Ideal Wing Nut. Conductors insulation shall extend into the wire connector.
   2. The connector shall be covered with vinyl plastic tape or with Raychem 600VAC heatshrink insulation.

F. Splices, taps and joints in exterior circuits shall be waterproofed by use of UL listed kits.
   1. In damp or wet locations such as outside lighting, provide watertight conductor connections.
   2. Sealing system shall be flame-retardant heat shrinkable watertight seal with heat activated sealants, Raychem or equal.

G. Compression fittings shall be installed with the manufacturer's recommended procedures and tools.

H. Mechanical connections shall be torqued utilizing the manufacturer's published torque requirements utilizing tools indicating torque values for the device being tightened.

3.5 COLOR CODE

A. Comply with the National Electrical Code.

B. Provide color code on conductors.

C. Color Code Method:
   1. Sizes #8 AWG and smaller: Conductor insulation shall have the color.
   2. Sizes #6 AWG and larger:
      a. Conductor insulation may have the color.
      b. Black conductor shall have tape bands minimum 2 inches wide. Tape bands shall be visible in all equipment enclosures, junction boxes, pull boxes, outlet boxes, condulets, splice & termination locations.

D. Unless otherwise noted, conductors shall be color coded as follows:
   1. For 277/480 Volt, 3 Phase, 4 Wire System:

Phase A	Brown
Phase B	Orange
Phase C	Yellow
Neutral	Gray
Ground	Green

   2. For 120/208 Volt, 3 Phase, 4 Wire System or 120/240 Volt, 3 Phase, 4 Wire Delta System:

Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White
Ground	Green

   3. Substitutions for the above colors are permitted, but the color coding for each system shall be maintained throughout all feeder and branch circuits for that system.

E. Identify and color code wire and cable under provisions of Section 26 0553. Identify each conductor with its circuit number or other designation indicated.

3.6 FIELD QUALITY CONTROL

A. Perform field inspection to assure all provisions of this specification are incorporated prior to Final Inspection.

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding components.

B. Building Grounding System consisting of Riser conductors and Grounding Plates located in Electrical rooms and Data closets.

C. Provide all components necessary to complete the grounding system(s) consisting of:
   1. Existing metal underground water pipe.
   2. Metal frame of the building.
   3. Existing metal underground gas piping system.
   4. Rod electrodes.

1.2 RELATED REQUIREMENTS

A. Section 26 0573 - Electrical Testing.

B. Section 26 4113 - Lightning Protection

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide for active electrodes and connections.

C. Project Record Documents: Record actual locations of components and grounding electrodes.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 ELECTRODES

A. Rod Electrodes: Copper-clad steel.
   1. Diameter: 5/8 inch.
   2. Length: 10 feet.

2.2 CONNECTORS AND ACCESSORIES

A. Exothermic Connections: Shall be used for all connections to rods.

B. Wire: Stranded copper.

C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.2 INSTALLATION

A. Bond all conduits and/or other conductor enclosures.

B. Bond all panelboards, safety switches and non-current carrying, metal enclosures of fixed equipment.

C. Provide bonding connection (minimum 2 AWG copper) from grounding electrode to the Telecommunications Main Grounding Busbar (TMGB) as required. Refer to Section 27 1005.

D. Provide a minimum 2 AWG copper wire bond across the water meter, to be attached to ground clamps on water line on each side of the meter.

E. Provide a code size copper wire grounding electrode conductor in Schedule 40 PVC conduit from the ground bus in the main building service disconnecting means (such as Main Switchboard) to the line side of the main inside water valve and union, and to structural steel, ground rods, and other metallic piping systems as per NEC.

F. No PVC conduit containing copper grounding/bonding conductors shall be allowed in plenums.

G. Provide bonding strap from neutral to ground inside the main service entrance equipment as per the NEC and the Georgia State Electrical Code.

H. Install additional rod electrodes as required to achieve specified resistance to ground.

I. In earth outdoors, install solid ground rods with the top at 12" below grade.

J. In wall under recessed panels, under exposed panels, or under freestanding equipment, install the solid ground rod with the top at maximum 6" above finished concrete floor. P.V.C. tape the top 12" of rod, extending down through the concrete.

K. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing. Bond steel together.

L. Provide bonding to meet requirements described in Quality Assurance.

M. Provide a separate grounding conductor in all flexible conduit.

N. Where a building ground network is provided, connect the neutral point on all dry type transformers to the nearest grounding plate/bus.

O. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
   1. Bond to all metal boxes that the conductors pass through, including, but not limited to, pull boxes, junction boxes, and outlet boxes. The means of connection shall be through a grounding screw or other listed grounding device that is used for no other purpose.

P. Interface with lightning protection system installed under Section 26 4113.

END OF SECTION

SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Conduit and equipment supports.

B. Anchors and fasteners.

1.2 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.3 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide manufacturer's catalog data for fastening systems.

1.4 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 MATERIALS

A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Supports: Fabricated of structural steel or formed steel members; galvanized or painted.all ferrous fasteners exposed to outside conditions and refrigerated spaces shall be coated with corrosion resistant, plated finish to prevent rust.

C. Anchors and Fasteners:
1. Do not use powder-actuated anchors.
2. Concrete Structural Elements: Use precast inserts, expansion anchors, or preset inserts.
3. Steel Structural Elements: Use beam clamps, steel spring clips, or welded fasteners.
4. Concrete Surfaces: Use expansion anchors.
5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.
6. Solid Masonry Walls: Use expansion anchors or preset inserts.
7. Sheet Metal: Use sheet metal screws.
8. Wood Elements: Use wood screws.

D. All ferrous fasteners exposed to outside conditions and refrigerated spaces shall be coated with corrosion resistant, plated finish to prevent rust.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
2. Do not drill or cut structural members.

3. Hanger rods shall not extend more than 1" below the equipment or mounting bracket. Trim any excess length.

B. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

C. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide a 3/4 inch fire resistant plywood backboard behind all surface-mounted cabinets, panelboards, telecommunications equipment, starters, relays, disconnect switches, and as shown.
   1. All backboards shall be coated with two (2) coats of insulating varnish over two (2) coats of fire resistant light gray enamel paint. Paint and finish shall be applied prior to installation.
   2. Plywood used in air plenums shall be non combustible, smoke retardant treated plywood.
   3. Anchor backboard to wall with 1/4-inch toggle bolts.

D. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall. Do not install plywood backboards in wet locations.

E. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

SECTION 26 0534

CONDUIT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Conduit, fittings and conduit bodies.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems.

D. Section 26 0537 - Boxes.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide for metallic conduit, liquidtight flexible metal conduit, nonmetallic conduit, and fittings.

C. Project Record Documents: Accurately record actual routing of conduits larger than 2 inches.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.6 ABBREVIATIONS

A. GRS indicates galvanized rigid steel conduit also termed rigid steel conduit .

B. RGS indicates galvanized rigid steel conduit also termed rigid steel conduit .

C. GRC indicates galvanized rigid steel conduit also termed rigid steel conduit .

D. IMC indicates intermediate metal conduit whether made of galvanized steel or aluminum. See Part 2 for specification.

E. EMT indicates Electrical Metallic Tubing whether made of galvanized steel or aluminum. See Part 2 for specification.

F. PVC40 indicates PVC electrical conduit, schedule 40.

G. PVC80 indicates PVC electrical conduit, schedule 80.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept conduit on site. Inspect for damage.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2.1 CONDUIT REQUIREMENTS

A. Conduit Size: Comply with NFPA 70.
   1. Minimum Size: 1/2 inch unless otherwise specified.

B. Underground Installations:
   1. More than 5 Feet from Foundation Wall: Use PVC Schedule 40.
   2. Within 5 Feet from Foundation Wall: Use rigid metal conduit.
   3. In or Under Slab on Grade: Use rigid metal conduit. Coordinate all in slab work with Structural.
   4. Minimum size 1/2 inch.

C. Outdoor Locations Above Grade: Use rigid metal conduit.

D. In Slab Above Grade:
   1. Use rigid metal conduit.
   2. Coordinate all in slab work with Structural.

E. Wet and Damp Locations: Use rigid metal conduit.

F. Dry Locations:
   1. Concealed: Use electrical metallic tubing where rigid conduit is not required elsewhere.
   2. Exposed: Use rigid metal conduit for all areas up to 8'-0" AFF. Exposed conduits installed in dry locations above 8'-0" AFF shall be EMT.

G. Fire Alarm: Provide factory painted (RED) electrical metallic tubing.

H. Intermediate Metal Conduit (IMC) may be substituted for Rigid Steel conduit as allowed by the National Electrical Code (NEC). All fittings shall be the same as for Rigid Steel conduit.

I. Branch Circuits to Motors: Use rigid metal conduit for all branch circuits to motors. Isolate actual motor connection from conduit system and from building with flexible conduit (liquidtight if wet or damp location) not less than four diameters nor more than 24-inches in length.

J. Telecommunications: Use electrical metallic tubing. Rigid Metal Conduit shall be required for Telecommunications service entrance cables where demarcation point is located more than fifty (50) feet beyond conduit building entry point. Refer to the National Electrical Code.

2.2 METAL CONDUIT

A. Rigid Metal Conduit.

B. Fittings and Conduit Bodies: Material to match conduit. Fittings shall be malleable iron threaded.

C. Intermediate Metal Conduit (IMC) may be substituted for Rigid Steel conduit as allowed by the National Electrical Code (NEC). All fittings shall be the same as for Rigid Steel conduit.

2.3 FLEXIBLE METAL CONDUIT

A. Description: Interlocked steel construction.

B. Connectors: Provide Zinc or cadmium plated steel. Fittings anchoring conduit by means of set screws are prohibited.

C. B-X cable is prohibited.

D. Provide separate grounding conductor inside flexible conduit.

E. Flexible conduit shall be liquid-tight neoprene coated in damp & wet locations and for all motor connections.

F. Flexible conduit shall be minimum 1/2-inch nominal.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Description: Interlocked steel construction with PVC jacket.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Fittings and Conduit Bodies: Steel or malleable iron compression type.

2.6 NONMETALLIC CONDUIT

A. Description: Schedule 40 PVC.

B. Fittings and Conduit Bodies: Material to match conduit.
   1. The conduit, fittings, elbows and cement shall be produced by the same manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.2 INSTALLATION

A. All line voltage conductors shall be placed in conduit unless otherwise noted.

B. All HVAC controls cabling specified in Section 23 0923 and Section 23 0913 shall be installed in conduit unless specifically stated otherwise in those sections.

C. All conduit shall be concealed unless otherwise noted.

D. Concealed raceway shall not be routed horizontally in masonry walls and partitions and shall not be routed horizontally more than 12 inches in stud and wall board partitions, except as noted.

E. Circuits shall be homerun to panels as indicated. No consolidation of homeruns shall be permitted unless specifically allowed elsewhere in these specifications or on the plans.

F. Metallic conduits in contact with ground, in gravel or sand fill, under and in slabs shall be covered with two coats of asphaltic paint.

G. Isolate all motor connections from building structure by installing liquid-tight flexible, nonmetallic conduit not less than four diameters nor more than 24 inches in length. Install in accordance with manufacturer's instructions. Support conduit per the National Electrical Code (NEC).

H. Where conduit rises through slab, provide a nonmetallic to rigid metal transition fitting, a preformed long radius steel elbow, and rigid metal conduit above grade or slab. Use bituminous coating on all rigid metal conduit from the nonmetallic to rigid coupling to at least six inches above grade or slab. No nonmetallic conduit shall extend above the floor slab.

I. Arrange supports to prevent misalignment during wiring installation.

J. Outside of building, provide minimum 3-inch concrete encasement around conduits inside a conduit ductbank, with minimum 1/2-inch rebar on each side of conduit ductbank.

K. Buried Conduit Exterior to Building:
   1. Bury conduit minimum 30-inches below finished grade beneath parking areas, drives and walkways except as noted.
   2. Bury conduit minimum 24-inches in other areas except as noted.
   3. Route conduit to avoid trees, shrubs and decorative plants.

4. Route along parallel to water, sewer, or storm drainage lines, but not located in the same ditch or trench.
5. Maintain 48-inches minimum horizontal spacing with water, sewer or storm drainage lines.

L. Support conduit using coated steel or malleable iron straps or clamps specifically designed for the purpose.

M. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits. Support rods shall not extend more than one inch below rack. Anchor supports by means of toggle bolts on hollow masonry units, expansion anchors on solid masonry units, machine screws on steel work and wood screws on wood members.

N. Fasten conduit supports to building structure and surfaces under provisions of Section 26 0529. Do not attach to other piping. Individual runs shall be anchored in place within three feet of changes in direction and at intervals not over eight feet.

O. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

P. Do not attach conduit to ceiling support wires or ceiling grid.

Q. Arrange conduit to maintain headroom and present neat appearance.

R. Route exposed conduit parallel and perpendicular to walls.

S. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

T. Route conduit in and under slab from point-to-point.

U. Do not cross conduits in slab.

V. Maintain minimum 3 inches clearance when crossing hot piping and 12 inches paralleling. Except where specific routing of conduit is shown, the contractor shall route conduits clear of all heating, ventilating and air conditioning ducts, sanitary piping, roof drains, storm water piping, sprinkler piping, domestic cold and hot water pipes, chilled water pipes, steam pipes, heating water pipes, and plumbing vents.

W. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.

X. Cut conduit square using saw or pipecutter; de-burr cut ends.

Y. Bring conduit to shoulder of fittings; fasten securely.

Z. Join nonmetallic conduits using cement as recommended by manufacturer. All joints shall be solvent welded in accordance with manufacturer's recommendations. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum. Bends in nonmetallic conduits shall conform to the National Electrical Code.

AA. Use conduit hubs to fasten conduit to cast boxes.

AB. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch size.

AC. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

AD. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.

AE. Provide insulated bushings on all conduits entering raceways, pullboxes, cabinets, outlet boxes, panelboards, switchboards, and at backboards and stub-ups.

AF. Provide insulated throat connectors on all EMT connections and on EMT entering outlet boxes, cabinets, panels, switchboards and at backboards and stub-ups.

AG. Provide #16 galvanized pullwire or minimum 200 lb. polyolefin pull cord in each empty conduit except sleeves and nipples.

AH. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

AI. Plugging: Seal all conduit runs which extend from interior to exterior of building and that enter and leave refrigerated spaces, to prevent the circulation of air. Stuff conduit ends with duct seal at nearest termination inside the building or outside refrigerated spaces. Sealant inside refrigerated spaces shall be white permagum.

AJ. Threads: Cut, clean and remove rough edges. Running threads shall not be used. Apply rust inhibiting coating to all threads.

AK. Connections to Motors: Where conduit cannot be attached to building within 18-inches of motor, a 3/4-inch minimum size vertical conduit shall be attached to ceiling and floor. Wiring shall be pulled into and and from this conduit through flexible conduit at condulets.

AL. Flexible metal conduit used to connect junction boxes to light fixtures shall not exceed 6 feet in length. Support conduit per the National Electrical Code (NEC).

AM. Ground and bond conduit under provisions of Section 26 0526.

AN. Identify conduit under provisions of Section 26 0553.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Penetration of fire rated walls, partitions, floors and ceilings: The contractor shall seal around all raceway penetrating fire rated walls, partitions, floors, and ceilings. Contractor shall utilize UL Listed material and shall install per UL Testing.

B. Install conduit to preserve fire resistance rating of partitions and other elements.

C. Route conduit through roof openings for piping and ductwork whenever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation specified herein.

END OF SECTION

SECTION 26 0536

CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cable trays and accessories.

B. Firestopping within (not around) cable trays.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Product Data: Provide data for tray, fittings, and accessories.

C. Shop Drawings: Indicate tray type, dimensions, support points, and finishes.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Square D: www.squared.com.

B. Thomas & Betts Corporation: www.tnb.com.

C. Wiremold Company: www.wiremold.com.

D. PW Industries: www.pwindustries.com

E. Mono-Systems: www.monosystems.com

F. MP Husky: www.mphusky.com

G. B-Line: www.b-line.com

H. Cope: www.tycoelectrical.com

2.2 LADDER-TYPE CABLE TRAY

A. Cable tray shall be UL Classified as an equipment grounding conductor.

B. Material: Formed aluminum.

C. Inside Width: 18 inches.

D. Inside Depth: 4 inches.

E. Straight Section Rung Spacing: 9 inches on center.
   1. Rungs shall have a minimum cable bearing surface of 1/2".
   2. Rungs shall be continuous square tube with radiused edges.

F. A full complement of fittings shall be available. All fittings and accessories shall be constructed of the same material as the cable tray.

G. Inside Radius of Fittings: 24 inches.

H. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.

2.3 SOLID-BOTTOM-TYPE CABLE TRAY

A. Description: NEMA VE 1, Class 20C solid bottom cable tray.

B. Material: Formed sheet steel, hot-dip galvanized after fabrication in accordance with ASTM A 123/A 123M, painted with gray epoxy.

C. Inside Width: As indicated.

D. Inside Depth: As indicated.

E. Inside Radius of Fittings: 12 inches. MINIMUM.

F. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.

G. Covers: Flanged, solid, flush cover.

2.4 WARNING SIGNS

A. Engraved Nameplates: 1/2 inch black letters on yellow laminated plastic nameplate, engraved with the following wording: "WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!"

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify exact field dimensions and conditions before ordering tray or roughing.

B. Verify that field measurements are as indicated.

3.2 INSTALLATION

A. Support trays in accordance with Section 26 0529. Provide supports at each connection point, at the end of each run, and at other points to maintain manufacturer recommended spacing between supports.

B. Size all thread hanger rods per manufacturer's recommendations.

C. Connections to supports shall be made with fittings and hardware specifically designed for the purpose. Disassembly of connection shall be welded.

D. Provide a support within two feet of any termination (end of run).

E. Provide sway bracing of horizontal runs at elbows and terminations. Sway brace shall be a one piece channel attached between the midpoint of the elbow radius (or end-point of termination) and the nearest building structural component.

F. Make attachments to structure only. Do not attach to piping, ductwork, or non-structural walls, floors, etc.

G. Use expansion connectors where required.

H. Cable tray shall not pass through a fire or smoke rated partition. Stop the cable tray within 4 inches of both sides of the fire/smoke partition and provide 4" Rigid Metal Conduit sleeves (number as required to match capacity of cable tray using 40% fill rule) through the rated partition. Seal around sleeves and inside sleeves around cables in accordance with Section 07 8400.

I. Ground and bond cable tray under provisions of Section 26 0526.
   1. Provide continuity between tray components.
   2. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly.
   3. Provide 2 AWG bare aluminum equipment grounding conductor through entire length of tray; bond to each component. Support at intervals of no more than four feet.
   4. Connections to tray may be made using mechanical or exothermic connectors.

J. Install warning signs at 50 feet centers along cable tray, located to be visible.

END OF SECTION

SECTION 26 0537

BOXES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall and ceiling outlet boxes.

B. Floor boxes.

C. Pull and junction boxes.

1.2 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 2726 - Wiring Devices: Wall plates in finished areas.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Provide cut sheets on floor outlet boxes only.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.1 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.
      a. Boxes and covers shall not be less than 1/16 inch thick.
      b. Box shall be anchored in place.
      c. Unless otherwise specified, ceiling outlet boxes need not be provided with plaster rings and shall be minimum two inches (2") deep. Boxes shall be provided with blank covers.
      d. Ceiling outlet boxes shall be four inch (4") octagonal or four and eleven-sixteenths inches (4-11/16") square as specified in the National Electrical Code due to number of wires.
   2. Concrete Ceiling Boxes: Concrete type.
   3. Switch and wall receptacles outlet boxes in plaster walls shall be four inches (4") square.
   4. In exposed masonry or tile walls, four inch (4") square boxes with deep plaster covers shall be used.

B. Cast Boxes: NEMA FB 1, Type FD, cast feralloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.

C. Wall Plates for Finished Areas: As specified in Section 26 2726.

2.2 FLOOR BOXES

A. Provide as shown, complete with service fittings or unactivated as indicated.

B. Floor boxes shall comply with NEMA OS 1.

C. All boxes in ground floor shall be watertight with threaded hubs. Boxes on other floors shall be concrete tight. All connections shall be made to prevent entrance of moisture. Where outlets are shown adjacent, two or three-gang boxes shall be used. Provide voltage barrier between power and communication sections.
   1. Watertight Boxes: Hubbell B2436(7) (3/4" or 1"), Steel City #641, Walker 854.
   2. Concrete Tight Boxes: Hubbell B2429(7), Steel City #641, Walker 854 with steel box.

D. Covers: Hubbell S-2425, Steel City P-64-3/4, (brass plate with 3/4" plug) except as listed below, cover for Walker 854.

E. Service Fittings: As specified in Section 26 2726.

F. Manufacturers:
   1. Hubbell
   2. Steel City
   3. Walker

2.3 PULL AND JUNCTION BOXES

A. All pullboxes and junction boxes shall be sized in accordance with the National Electrical Code.

B. Sheet Metal Boxes: Galvanized steel.

C. Hinged Enclosures: As specified in Section 26 2716.

D. Surface Mounted Exposed Boxes: Boxes shall be corrosion resistant cast iron in wet locations. Use solid steel boxes with no knockouts in dry locations. Holes for raceways shall be drilled on the job.

E. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
   1. Material: Galvanized cast iron.
   2. Cover: Furnish with ground flange, neoprene gasket, and galvanized steel cover/screws.

F. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:
   1. Material: Galvanized cast iron.
   2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify locations of floor boxes and outlets in offices and work areas prior to rough-in.

3.2 INSTALLATION

A. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.

C. No more than one box extension shall be installed on any outlet or pull box. Larger boxes shall be installed as required per NEC.

D. Provide outlet boxes for lighting fixtures, wall switches, wall receptacles, telecommunications equipment, protection equipment, and all equipment.

E. Coordinate installation of outlet boxes for equipment connected under Section 26 2717.

F. Unless otherwise indicated wall outlet boxes shall be placed with center lines at distances above the finished floor (except at casework) as follows:
   1. Convenience Outlets: 18"
   2. Switches: 42"
   3. Clocks: 8'-2" or 12" below ceiling. Conform to lowest mounting.
   4. Fire Alarm Pull Stations: 48" to the operable handle.
   5. Fire Alarm Visual or Horn/Visual: 80" or 6" below ceiling - conform to lowest mounting. Note that this measurement is to the BOTTOM of the lens on the device.
   6. Television Outlets: 18 inches
   7. Telecommunications Outlets: 18 inches
   8. Wall Phone Outlets: Per ADA requirements.
   9. Drinking Fountain Outlets: As recommended by manufacturer.

G. The approximate locations of outlets are shown on the plans. The exact locations shall be determined at the building. The right is reserved to change the exact location of any outlet a maximum of 10 feet before it is permanently installed without additional cost.

H. Orient boxes to accommodate wiring devices oriented as specified in Section 26 2726.

I. Maintain headroom and present neat mechanical appearance.

J. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

K. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

L. Install boxes to preserve fire resistance rating of partitions, walls, floors and other elements, using materials and methods specified.

M. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

N. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

O. Where outlets are shown above cabinets and casework, the outlets shall be mounted so the bottom of the device plates will be 1 to 3 inches above the backsplash.
   1. Where outlets of different levels are shown adjacent, they shall be installed in one vertical line. Outlets shown back to back on a common wall shall be offset a minimum of 10 inches to dampen sound transmission through the wall. On all walls with 1 hour or greater fire rating, "back to back" outlets shall be minimum 24 inches apart with a stud between outlets for gypboard constructed partition.
   2. Where the mounting height of an outlet is not shown on the plans or specifications, the contractor shall contact the architect for exact mounting height requirements.
   3. At locations where two or more devices are shown adjacent and at the same mounting height, they shall be installed in one outlet box and covered with one face plate.

P. Where outlets are installed in unfinished block or tile partitions, they shall be installed at the points in the tile to permit the face plate to cover the rough opening. The horizontal and vertical locations indicated may be altered to permit doing this. However, contractor shall check the Architectural drawings to prevent conflicts when shifting location. Where outlets are shown back to back on a common wall, they shall be offset 10" to avoid sound transmission.

Q. Outlets in Poured-in-Place Concrete: A six by six by three inch (6"X6"X3") deep wood box shall be placed in the form before the concrete is poured. This box shall be removed before waterproofing is applied. Install outlet and grout around the box. Boxes shall be set so that cover plates are flush.

R. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

S. Use flush mounting outlet box in finished areas.

T. Do not install flush mounting box back-to-back in walls; provide minimum 10 inches separation. Provide minimum 24 inches separation in acoustic and fire rated walls.

U. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

V. Use stamped steel bridges to fasten flush mounting outlet box between studs.

W. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

X. Use adjustable steel channel fasteners for hung ceiling outlet box.

Y. Do not fasten boxes to ceiling support wires.

Z. Support boxes independently of conduit. Provide threaded rods, screws, bolts, toggle bolts, etc. for support. Do not use clips or other hardware to attach boxes to ceiling grids.

AA. Use gang box where more than one device is mounted together. Do not use sectional box.

AB. Use two gang box with plaster ring for single device outlets.

AC. Use cast outlet boxes in exterior locations exposed to the weather and wet locations.

AD. Use cast outlet boxes for all surface mount box installations in Mechanical Rooms.

AE. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

AF. Floor boxes shall be set an readjusted to provide a smooth surface, conforming to elevation and slope of the surrounding finished floor. In carpeted areas, flanges shall be installed to protect carpet edges. Provide tapped holes in all boxes as determined by conduit entering box.

AG. A carpet flange shall be installed on floor boxes in all carpeted areas. In non-carpeted areas, a beveled carpet flange shall be installed with the entire perimeter in contact with the floor finishing material, and caulking compound shall be provided beneath the flange to keep water from seeping under the flange.

AH. Set floor boxes level.

AI. Boxes for any specialty devices such as speakers, fire alarm horns and stations, and program signals shall be obtained from the equipment manufacturer.

3.3 ADJUSTING

A. Adjust floor boxes flush with finish flooring material.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused box openings.

3.4 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates and labels.

1.2 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.1 NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, white letters on black background.

B. Nameplates: White core black bakelite, white letters on black background.

C. Locations:
1. Each electrical distribution and control equipment enclosure, including but not limited to all panelboards, disconnect switches, switchboards, starters, contactors, and circuit breakers in Main Service Panel or Switchboard.

D. Letter Size:
1. Use 1/4 inch letters for identifying individual equipment designation and voltages.
2. Use 1/8 inch (3 mm) letters for identifying the Feeder Circuit Description as described below.

E. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background. Use only for identification of individual wall switches and receptacles, control device stations, etc.

2.2 SYSTEMS PULLBOXES

A. Boxes in systems raceways shall be color coded as follows:

Fire Alarm	Red
Security	Green
Program Clock & Bell	Blue
Telephone System	White
Data System	Orange
Sound/Public Address	Black
Television	Brown

PART 3 EXECUTION

3.1 PREPARATION

3.2 INSTALLATION

A. Install nameplates and labels parallel to equipment lines.

B. Secure nameplates to equipment front using epoxy glue.

C. Secure nameplates to inside surface of door on panelboard that is recessed in finished locations.

D. Panelboard, Disconnect Switch, and Switchboard labels shall include the following three lines:
   1. Designation (or Equipment Served for disconnect switch) - ie "PANEL H1" or "AH-1A".
   2. Voltage Description - ie "480Y/277 VOLTS" or "208Y/120 VOLTS".
   3. Feeder Circuit Description - ie "FED FROM L1A-20" or "FED FROM H1-20 VIA XFMR X1A".

E. Boxes installed in branch and feeder circuit raceways shall be identified by printing the panel and circuit number on the box cover.

F. All boxes installed in emergency circuits shall be painted yellow.

G. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.

END OF SECTION

SECTION 26 0573

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Performance requirements for overcurrent protective devices.

B. Short circuit study.

C. Coordination study and analysis.

1.2 RELATED REQUIREMENTS

A. Section 26 2817 - Enclosed Circuit Breakers.

B. Section 26 2413 - Switchboards: Overcurrent protective devices in switchboards.

C. Section 26 2416 - Panelboards: Overcurrent protective devices in panelboards.

D. Section 26 2813 - Fuses.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; 2008 with 2009 Georgia State Amendments.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements for submittal procedures.

B. Study Preparer's Qualifications.

C. Study Report: Submit short circuit and protective device studies as specified, prior to submission of product data submittals or ordering or fabrication of protective devices.
   1. Evaluation of product data submittals by the Architect will not commence until acceptable studies have been submitted.
   2. Include stamp or seal and signature of preparing engineer.

D. Field Engineer Qualifications.

E. Field Inspection Report: Show final adjusted settings of protective devices.

F. Certificates: Prior to final inspection, certify that field adjustable protective devices have been set in accordance with requirements of protective device analysis.

G. Project Record Documents: Revise protective device study as required to show as-built conditions.
   1. Submit not less than 60 days prior to final inspection of electrical system.
   2. Include hard copies in operation and maintenance data submittals.
   3. Include all files prepared using software packages, on CD-ROM, with file name cross-references to specific pieces of equipment and systems.

1.5 PROTECTIVE DEVICE STUDY

A. Analyze the specific electrical and utilization equipment (according to NEC definition), the actual protective devices to be used, and the actual feeder lengths to be installed.
   1. Scope of Studies: All new distribution wiring and equipment, from primary source to buses and branch circuit panelboards.
   2. Study Methodology: Comply with requirements and recommendations of NFPA 70, IEEE 399, and IEEE 242.
   3. Report: State the methodology and rationale employed in making each type of calculation; identify computer software package(s) used.

B. One-Line Diagrams: Prepare schematic drawing of electrical distribution system, with all electrical equipment and wiring to be protected by the protective devices; identify nodes on the diagrams for reference on report that includes:
   1. Calculated fault impedance, X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at the main switchboard bus and all downstream devices containing protective devices.
   2. Breaker and fuse ratings.
   3. Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
   4. Identification of each bus, with voltage.
   5. Conduit materials, feeder sizes, actual lengths, and X/R ratios.

C. Short Circuit Study: Calculate the fault impedance to determine available 3-phase short circuit and ground fault currents at each bus and piece of equipment during normal conditions, alternate operations, emergency power conditions, and other operations that could result in maximum fault conditions.
   1. Show fault currents available at key points in the system down to a fault current of 7,000 A at 480 V and 208 V.
   2. Include motor contributions in determining the momentary and interrupting ratings of the protective devices.
   3. Primary Fault Level Assumptions: Obtain data from utility company.
   4. Report: Include all pertinent data used in calculations and for each device include:
      a. Device identification.
      b. Protective device.
      c. Device rating.
      d. Calculated short circuit current, asymmetrical and symmetrical, and ground fault current.

D. Coordination Study: Perform an organized time-current analysis of each protective device in series from the individual device back to the primary source, under normal conditions, alternate operations, and emergency power conditions. Analysis shall include ground fault devices.
   1. Graphically illustrate that adequate time separation exists between series devices, including upstream primary device.
   2. Plot the specific time-current characteristics of each protective device on log-log paper.
   3. Organize plots so that all upstream devices are clearly depicted on one sheet.
   4. Also show the following on curve plot sheets:
      a. Device identification.
      b. Voltage and current transformer ratios for curves.
      c. 3-phase and 1-phase ANSI damage curves for each transformer.
      d. No-damage, melting, and clearing curves for fuses.
      e. Cable damage curves.
      f. Transformer inrush points.
      g. Maximum short circuit cutoff point.
      h. Simple one-line diagram for the portion of the system that each curve plot illustrates.
      i. Software report for each curve plot, labeled for identification.
   5. Elevators: In buildings with more than one elevator supplied by a single feeder, the overcurrent protective devices in each disconnecting means shall be selectively coordinated with any other supply side overcurrent protective devices, including any disconnect or circuit breaker located at an emergency generator. Make necessary adjustments or recommendations for alternate equipment to comply with Article 620.62 of the 2005 National Electrical Code.

E. Analysis: Determine ratings and settings of protective devices to minimize damage caused by a fault and so that the protective device closest to the fault will open first.

1. Required Ratings and Settings: Derive required ratings and settings of protective devices in consideration of upstream protective device settings and optimize system to ensure selective coordination.
2. Identify any equipment that is underrated as specified.
3. Identify existing protective devices that will not achieve required coordination and cannot be field adjusted to do so.
4. Identify specified protective devices that will not achieve required protection or coordination but with minor changes can be made to do so; provide such modified devices at no additional cost to the Owner and identify them on submittals as "revised in accordance with Protective Device Coordination Study"; minor changes include different trip sizes in the same frame, time curve characteristics of induction relays, CT ranges, etc.
5. Identify specified protective devices that will not achieve required protection or coordination and cannot be field adjusted to do so, and for which adequate devices would involve a change to the contract sum.
6. In all cases where adequate protection or coordination cannot be achieved at no extra cost to the Owner, provide a discussion of alternatives and logical compromises for best achievable coordination.
7. Do not order, furnish, or install protective devices that do not meet performance requirements unless specifically approved by the Architect.

F. Protective Device Rating and Setting Chart: Summarize in tabular format the required characteristics for each protective device based on the analysis; include:
   1. Device identification.
   2. Relay CT ratios, tap, time dial, and instantaneous pickup.
   3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
   4. Fuse rating and type.
   5. Ground fault pickup and time delay.
   6. Input level and expected response time at two test points that are compatible with commonly available test equipment and the ratings of the protective device.
   7. Highlight all devices that as furnished by the Contractor will not achieve required protection.

G. Arc Flash Hazard Study: Provide an Arc Flash Hazard Study for the electrical distribution system shown on the power riser diagram. The intent of the Arc Flash Hazard Study is to determine hazards that exist at each major piece of electrical equipment shown on the power riser diagram. This includes switchboards, panelboards, and transformers.
   1. The study shall be performed after the short circuit and protective device coordination study has been completed based upon IEEE Std. 1584, "IEEE Guide for Performing Arc Flash Hazard Calculations".
   2. Pertinent data, rationale employed, and assumptions in developing the calculations shall be incorporated in the introductory remarks of the study.
   3. The study shall be in accordance with the latest adopted versions of NFPA 70E, OSHA 29-CFR, Part 1910 Subpart S and IEEE 1584 Standards.
   4. The study shall determine the following:
      a. Flash Hazard Protection Boundary
      b. Limited Approach Boundary
      c. Restricted Boundary
      d. Prohibited Boundary
      e. Incident Energy Level
      f. Required Personal Protective Equipment (PPE) Class
      g. Type of Fire Rated Clothing

5. The study shall include creation of Arc Flash Hazard Warning Labels. These labels serve as a guide to assist technicians and others in the selection of proper PPE when working around exposed and energized conductors. Include the bus name, system operating voltage, and date of issue. Labels shall be printed in color on adhesive backed labels.
6. The Contractor shall install the warning labels.

1.6 QUALITY ASSURANCE

A. Study Preparer Qualifications: Electrical testing agency regularly engaged in short circuit and coordination studies, with at least 5 years experience in work of this type, and employing professional electrical engineer licensed in Georgia to perform the studies.

B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

C. The Contractor's Responsibility: Provide all project-related data needed by study preparer, including equipment, wire sizes, insulation types, conduit types, and actual circuit lengths.

PART 2 PRODUCTS

2.1 PROTECTIVE DEVICES

A. Provide protective devices of ratings and settings as required so that the protective device closest to the fault will open first.

B. In addition to requirements specified elsewhere, provide overcurrent protective devices having ratings and settings in accordance with results of this analysis.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. Provide the services of a qualified field engineer and necessary tools and equipment to test, calibrate, and adjust the installed protective devices to conform to requirements determined by the coordination analysis.

B. Adjust installed protective devices having adjustable settings to conform to requirements determined by the coordination analysis.

C. Submit report showing final adjusted settings of all protective devices.

END OF SECTION

SECTION 26 0574

ELECTRICAL TESTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Infrared Scan of Electrical Gear.

B. Grounding Tests.

C. Insulation Testing.

1.2 RELATED SECTIONS

A. Section 26 2200 - Dry Type Transformers

B. Section 26 2817 - Enclosed Circuit Breakers.

C. Section 26 2413 - Switchboards: Overcurrent protective devices in switchboards.

D. Section 26 2416 - Panelboards: Overcurrent protective devices in panelboards.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code; 2008 with 2009 Georgia State Amendments.

1.4 SUBMITTALS

A. See Section 260510 - General Electrical Requirements for submittal procedures.

B. Electrical Testing Firm Qualifications.

C. Provide a sketch and written description of the testing procedures to the utilized for review by the Architect at least six (6) weeks prior to performing the test.

D. The test report shall indicate the measure impedance to ground for the ground bus of the main service entrance switchboard and a list of all dry type transformers, panelboards, and distribution panelboards with a statement concerning the installation at each ground and neutral bus.

E. Provide test report as described in Insulation Testing.

F. Project Record Documents:
   1. Submit not less than 60 days prior to final inspection of electrical system.
   2. Include copy of all test reports and a written description of what actions were taken to resolve any problems encountered.
   3. Types and dates for calibration of all instruments shall be listed in the final test reports.

1.5 QUALITY ASSURANCE

A. Testing Firm Qualifications: Electrical testing agency regularly engaged in the tests specified herein, with at least 5 years experience in work of this type.

B. The subcontractor performing the services in this section shall review the Contract Documents and existing conditions prior to performing any tests.

PART 2 PRODUCTS

2.1 INSTRUMENTS

A. Instruments for which calibration is periodically required and which will be utilized for testing the electrical system and equipment shall have been calibrated within a period of six (6) months prior to the testing.

PART 3 EXECUTION

3.1 INFRARED SCAN

A. Scan the interiors of all panelboards, switchboards, and dry type transformers using optical instrumentation sensitive to the infrared wave length to observe, catalog, and analyze thermal variations.

B. During the scan (survey), each problem observed shall be recorded with both a thermogram (photograph of the thermal gradient) and a standard color photograph.

C. The thermograms and photographs shall be identified and correlated with a verbal description of the observed anomaly.

D. Anomalies shall be categorized as Class 1, 2, or 3 as follows:
   1. Class 1 anomalies shall be for items with a minor temperature differential of less than 20 degrees Celsius.
   2. Class 2 anomalies shall be for items with a temperature differential greater than 20 degrees Celsius but less than 80 degrees Celsius.
   3. Class 3 anomalies shall be for items with a temperature differential greater than 80 degrees Celsius.

3.2 GROUND TEST

A. Measure the impedance to ground from the bus of the main service entrance switchboard with all circuit breakers open and the link between the neutral and ground busses removed.

B. Replace the link between the neutral and ground busses after the test is complete.

C. Visually verify the connection of the equipment grounding conductors for each feeder in the main service entrance switchboard to the ground bus.

D. Visually verify the grounding of each derived secondary at each dry type transformer. See Section 26 0526 - Grounding and Bonding for specified connections.

E. Visually verify the ground connection of the separate ground bus in each panelboard to the equipment grounding conductor.

F. Verify all branch equipment ground conductors are connected to the separate panelboard ground bus.

G. Verify that no grounding conductors are connected to the neutral bus and no neutral conductors are connected to the ground bus.

H. Verify that there are no links between the neutral and ground busses except at the main service entrance gear.

3.3 INSULATION TESTING

A. Perform a megohm test of all phase and neutral conductors from the service transformer, through the main service entrance switchboard, through all power distribution panelboards, and to all branch circuit panelboard main busses.

B. Provide a written report identifying each feeder and conductor and indicating the resistivity to ground (in megohms) of the insulation.

END OF SECTION

SECTION 26 2200

LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Two-winding transformers.

1.2 RELATED REQUIREMENTS

A. Section 26 0574 - Electrical Testing.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0534 - Conduit: Flexible conduit connections.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Product Data: Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

C. Test Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual locations of transformers.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Eaton Electrical/Cutler-Hammer: www.eatonelectrical.com.

B. GE Industrial: www.geindustrial.com.

C. Square D: www.squared.com.

D. Siemens: www.siemens.com

2.2 TWO-WINDING TRANSFORMERS

A. Description: NEMA ST 20, factory-assembled, air cooled dry type transformers, ratings as indicated.

B. Primary Voltage: 480 volts, 3 phase.

C. Secondary Voltage: 208Y/120 volts, 3 phase.

D. Insulation system and average winding temperature rise for rated kVA as follows:
1. 1-15 kVA: Class 185 with 115 degrees C rise.
2. 16-500 kVA: Class 220 with 115 degrees C rise.

E. Case Temperature: Do not exceed 35 degrees C rise above ambient at warmest point at full load.

F. Windings: Copper.

G. Winding Taps:
1. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
2. Transformers 15 kVA and Larger: NEMA ST 20.

H. Sound Levels: NEMA ST 20.

I. Basic Impulse Level: 10 kV.

J. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

K. Mounting:
1. 1-15 kVA: Suitable for wall mounting.
2. 16-75 kVA: Suitable for floor or trapeze mounting.
3. Larger than 75 kVA: Suitable for floor mounting.

L. Coil Conductors: Continuous windings with terminations brazed or welded.

M. Transformer coils shall be vacuum impregnated with non-hygroscopic, thermosetting varnish and shall have a final wrap of electric insulating material designed to prevent injury to the magnet wire. Transformers having coils with magnet wire visible are not acceptable.

N. On units 500 kVA and smaller the vibration isolating system shall be so designed as to provide for continual securement of the core and coil unit to the enclosure.

O. Sound isolating systems requiring the removal of all tie down facilities are not acceptable.

P. Transformer Enclosure: NEMA ST 20.
1. Type 1.
2. Ventilated.
3. All ventilating openings shall be of the louvered type. Expanded metal coverings are not acceptable.
4. The base of the transformer shall be constructed of minimum 12 gauge steel, with stamped openings for ventilation.
5. Provide lifting eyes or brackets.
6. The enclosure shall be degreased, cleaned and phosphatized with one coat of zinc chromate primer and one coat of baked enamel.

7. The core and coil shall be visibly grounded to the frame of the transformer cubicle by means of a flexible strap.
8. A maximum case temperature shall not exceed a 35 degree Celsius rise above ambient at its warmest point.

Q. Isolate core and coil from enclosure using vibration-absorbing mounts.

R. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

PART 3 EXECUTION

3.1 INSTALLATION

A. Set transformers plumb and level.

B. Use flexible conduit, under the provisions of Section 26 0534, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

C. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by the manufacturer. Provide plywood backboard for mounting and reinforce wall as required to support the transformer.

D. Mount floor-mounted transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.
1. Pads shall be rubber in shear type isolating pads under each transformer corner. Bolt the isolator to the transformer and to the floor or support.

E. Mount trapeze-mounted transformers as indicated. See mounting detail on drawings.

F. Provide seismic restraints.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Coordinate transformer suspension with Architect to minimize noise transmission. In each suspension rod, provide a spring hanger isolator.

3.2 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

SECTION 26 2413

SWITCHBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Switchboards.

B. Switchboard accessories.

1.2 RELATED REQUIREMENTS

A. Section 26 0574 - Electrical Testing.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.

C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; and switchboard instrument details.

D. Test Reports: Indicate results of factory production tests.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Project Record Documents: Record actual locations of switchboards.

G. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Cutler-Hammer.

B. GE Industrial.

C. Square D.

D. Siemens.

2.2 SWITCHBOARDS

A. Ratings:
   1. Voltage: 277/480 volts.
   2. Configuration: Three phase, four wire, grounded.
   3. Main Bus: As shown on drawings.
   4. Integrated Equipment Rating: 100,000 rms amperes symmetrical.
   5. Neutral: Full capacity.

B. Main Section Devices: Individually mounted and compartmented.

C. The section containing the main circuit breaker shall be listed as "service entrance" equipment,

D. Distribution Section Devices: Group Mounted.

E. Bus Material: Copper, standard size. Bus bars shall be braced to withstand same rms symmetrical ampere rating as stated in Integrated Equipment Rating above.

F. Bus Connections: Bolted, accessible from front for maintenance.

G. Ground Bus: Extend length of switchboard.

H. Individual circuit breaker compartment shall have a formed removable steel door which will allow breaker operation with the door closed.

I. Insulated Case Main Circuit Breaker:
   1. Main breaker shall be insulated case, draw-out type.
   2. Breaker shall be solid state, LSIG rated.
   3. Shall be listed for 100% of their continuous ampere rating.
   4. Provide with ground fault protection.
   5. Breakers shall have two step stored energy mechanism. The mechanism shall be manually charged and shall be capable of manual discharge without closing the breaker.
   6. The breaker control face plate shall include visual indicators for "open" and "closed" positions, "charged" and "discharged" Positions, and shall have controls for opening and closing the breakers.
   7. Visual indicators for overload, short circuit, and ground fault shall indicate cause for automatic tripping.

J. Molded Case Circuit Breakers: Integral thermal and instantaneous magnetic trip in each pole.
   1. All feeder circuit breakers shall be group mounted thermal magnetic molded case type.
   2. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
   3. Include shunt trip where indicated.
   4. Include ground fault trip where indicated.

K. Time-Current Study:
   1. The switchboard manufacturer shall perform a time-current coordination study for all feeders served by the switchboard and shall set all breakers at the recommended trip settings.

2. Feeder data shall be obtained from the Architect by requesting the information, in writing, at least 28 days before final observation, certifying that all devices have been set per the recommended results of the time-current study.

L. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.

M. Ground Fault Sensor: Zero sequence type.

N. Ground Fault Relay: Adjustable ground fault sensitivity from 200 to 1200 amperes, time delay adjustable from 0 to 15 seconds. Provide monitor panel with lamp to indicate relay operation, TEST and RESET control switches.

O. Conduit Entry: Top and Bottom as required.

P. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.

Q. Pull Box: Removable top and sides, same construction as switchboard.
1. Provide insulating, fire-resistive bottom with separate openings for each circuit to pass into switchboard.

R. Enclosure: Type 1 - General Purpose.
1. Align sections at rear only.
2. Individual sections shall be front accessible only.
3. Sections shall be bolted together for ease of shipment and installation.
4. Adequate lifting means shall be provided and sections shall be capable of being bolted directly to the floor without the use of floor sills.
5. The switchboard shall fit into allocated space as shown on the plans.
6. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
7. Mimic Bus: Show bussing, connections and devices in single line form on the front panels of the switchboard.
   a. Use blue factory painting.
   b. Use plastic strips.
   c. Fasten strips flat against the panel face with screws or rivets.
8. Individual sections shall be constructed of code gauge steel.

2.3 POWER METERS

A. Manufacturers:
1. Square D Power Logic Circuit Monitor Series 2000.
2. Square D Power Meter Series 3020.
3. GE Power Leader Electronic Power Meter.
4. GE Power Quality Meter.
5. Cutler Hammer IQ Analyzer.

B. Electric meter must be capable of measuring kWh consumption, kW demand and providing kyz (kWh) pulse outputs.

C. Current transformers for use with the meters shall have minimum accuracy of 1%.

D. Meters requiring an additional option board for kyz pulse output shall have the option board installed in the meter and configured to provide kyz pulses.

E. Meters must have the capability of displaying phase currents and phase voltages on all phases and totals for each main breaker.

F. Meters shall be provided with Normal and Alternate display modes providing the standard program for factory programmed kV meters.

G. Provide additional metering modules as required so that all feeder breakers in the Main Switchboard are sub-metered. These shall be interfaced with the main meter such that total OR individual breaker loads can be monitored.

2.4 ACCESSORIES

A. Circuit Breaker Lifting Device: Carriage and track on top of each switchboard with lifting device to serve the main draw-out circuit breaker in switchboard.

PART 3 EXECUTION

3.1 PREPARATION

A. Provide concrete housekeeping pad under the provisions of Section 03 3000.

B. Verify that field measurements are as indicated on shop drawings.

3.2 INSTALLATION

A. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

B. Install a 1" conduit from each meter to the nearest DDC system panel. Provide pullstring in conduit and additional pullboxes as necessary.

C. The building electrical power riser shall be framed behind clear plastic and mounted on the wall in the Main Electrical Room.

3.3 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement.

B. Tighten bolted bus connections in accordance with manufacturer's instructions.

C. Adjust circuit breaker trip and time delay settings to values indicated.

3.4 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 26 2416

PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

1.2 RELATED REQUIREMENTS

A. Section 26 0574 - Electrical Testing.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.

E. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 MAINTENANCE MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Furnish two of each panelboard key.

PART 2 PRODUCTS

2.1 POWER DISTRIBUTION PANELBOARDS

A. Manufacturers: Square D, General Electric, Cutler-Hammer, ITE/Siemens Allis.

B. Description: NEMA PB 1, circuit breaker type, factory assembled.

C. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard, bonded to panel enclosure.

D. Bus Assembly Arrangement: Distribution phase sequence type vertically numbered so that odd numbered single poles and spaces are located on the left. No two single poles or spaces, vertically, shall be connected to the same phase. All current carrying parts shall be plated. See schedules for special arrangements.

E. Minimum integrated short circuit rating:
1. 208/240 Volt Panelboards: 10,000 amperes rms symmetrical.
2. 480 Volt Panelboards: 14,000 amperes rms symmetrical.
3. Series rating is not allowed.

F. Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole; UL listed. For air conditioning equipment branch circuits provide circuit breakers UL listed as Type HACR. All load side connections of the same breaker shall be in the same gutter for multi-pole breakers.

G. Enclosures shall be NEMA 1 unless otherwise noted. Dimensions of enclosure shall not exceed what is shown on the plans.
1. Provide with code size side and end gutters, 4 inch minimum.
2. Enclosure shall be constructed of galvanized code gauge steel.
3. Boxes shall NOT be furnished with concentric knockouts pre-punched by the manufacturer.

H. Cabinet Front: Surface type, fastened with adjustable, concealed trim clamps, hinged door with flush lock, metal directory frame, finished in rust inhibiting prime coat and manufacturer's standard gray enamel. Provide with Door-in-Door type enclosure. Directory cover shall be glass or clear plastic. Front shall be constructed of code gauge steel.

2.2 LIGHTING AND APPLIANCE PANELBOARDS

A. Manufacturers: Square D, General Electric, Cutler-Hammer, ITE/Siemens Allis.

B. Description: NEMA PB1, circuit breaker type, factory assembled lighting and appliance branch circuit panelboard.

C. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard, bonded to panel enclosure; provide insulated ground bus where scheduled.

D. Bus Assembly Arrangement: Distribution phase sequence type vertically numbered so that odd numbered single poles and spaces are located on the left. No two single poles or spaces, vertically, shall be connected to the same phase. All current carrying parts shall be plated. See schedules for special arrangements.

E. Minimum Integrated Short Circuit Rating:
1. 208/240 Volt Panelboards: 10,000 amperes rms symmetrical.
2. 480 Volt Panelboards: 14,000 amperes rms symmetrical.
3. Series rating is not allowed.

F. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, quick-make, quick-break, ambient compensated with common trip handle for all poles; UL listed.
1. Type SWD for lighting circuits.
2. Type HACR for air conditioning equipment circuits.
3. Class A ground fault interrupter circuit breakers where scheduled.
4. Do not use tandem circuit breakers.
5. All load side connections of the same breaker shall be in the same gutter for multi-pole breakers.

G. Enclosure: NEMA PB 1, Type 1.
1. Provide with code size side and end gutters, 4 inch minimum.

2. Enclosure shall be constructed of galvanized code gauge steel.
3. Boxes shall NOT be furnished with concentric knockouts pre-punched by the manufacturer.

H. Cabinet Box: 6 inches deep, 20 inches wide for 240 volt and less panelboards, 20 inches wide for 480 volt panelboards.

I. Cabinet Front: Flush cabinet front with adjustable, concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Provide with Door-in-Door type enclosure. Directory cover shall be glass or clear plastic. Finish with rust inhibiting prime coat and manufacturer's standard gray enamel.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install panelboards plumb. Install recessed panelboards flush with wall finishes.

B. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.

C. Provide 4 inch high, 6 inch deep concrete housekeeping pad beneath each surface mounted panelboard. The concrete pad shall enclose all conduits feeding into the panelboard from the floor.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads. Directory shall contain complete equipment identification and space numbers of all spaces controlled by branch circuits.

F. Provide engraved plastic nameplates under the provisions of Section 26 0553.

G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
1. Minimum spare conduits: 3 empty 3/4 inch.

H. Shunt Trip Circuit Breakers: Provide conduit and conductors to interlock control of shunt trip breakers.

I. Ground and bond panelboard enclosure according to Section 26 0526.

END OF SECTION

SECTION 26 2417

SURGE PROTECTIVE DEVICES (SPDS)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Low Voltage AC Surge Protection for Electrical Distribution Systems

1.2 RELATED SECTIONS

A. Section 26 2413 - Switchboards

B. Section 26 2416 - Panelboards

1.3 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

B. ANSI/UL 1449 - Third Edition

1.4 DEFINITIONS

A. Where items are shown as "lightning arrestor", "lightning suppressor", "surge arrestor", "arrestor", "suppressor", "transient voltage surge suppressor" (TVSS), or "surge suppressor", provide Surge Protective Device (SPD).

1.5 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL). Compliance may be in the form of a file number that can be verified on UL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (In).

C. For sidemount mounting applications (SPD mounted external to electrical assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

D. Product Data: Provide data sheets for each different component to be used.
   1. Provide a list of device locations with the corresponding device type proposed.
   2. Show that Surge Protective Devices (SPDs) and associated components are manufactured in the United States of America.

E. Submit a copy of the written guarantee.

F. Provide a letter stating that the manufacturer shall provide unit replacement within 48 hours of notification by the Owner with or without prior receipt of damaged parts.

G. Operationing and Maintenance Data:
   1. Submit the service organization name and phone number.
   2. Operation and maintenance manuals shall be provided with each SPD shipped.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3rd Edition).

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.8 WARRANTY

A. The manufacturer shall provide a full five (5) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

B. Warranty shall begin upon the date of final building acceptance by the Owner.

C. During the warranty period, the manufacturer shall provide new SPDs to arrive at the Owner's premises within 48 hours of the Owner's request.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. APT

B. Liebert

C. Square D

D. General Electric

E. Eaton

F. Siemens

G. Surge Suppression, Inc.

2.2 VOLTAGE SURGE SUPPRESSION - GENERAL

A. Electrical Requirements:
   1. Unit Operating Voltage - Refer to drawings for operating voltage and unit configuration.
   2. Maximum Continuous Operating Voltage (MCOV) - The MCOV shall not be less than 125% of the nominal system operating voltage.
   3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
   4. Protection Modes - The SPD must protect all modes of the electrical system being utilized. The required protection modes are:
      a. Line-to-Neutral
      b. Line-to-Ground
      c. Line-to-Line
      d. Neutral-to-Ground
   5. Nominal Discharge Current (In) - All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20kA shall be rejected.
   6. ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) - The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:
      a. 480Y/277 Volts:
         1) L-N, L-G, N-G = 1200
         2) L-L = 2000
      b. 208Y/120 Volts:
         1) L-N, L-G, N-G = 800

2) L-L = 1200

B. SPD Design:
1. Maintenance Free Design - The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
2. Balanced Suppression Platform - The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
3. Electrical Noise Filter - Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 30 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.
4. Internal Connections - No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. Monitoring Diagnostics - Each SPD shall provide the following integral monitoring options:
   a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
      1) For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.
      2) For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.
      3) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.
   b. Remote Status Monitor - The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
   c. Audible Alarm and Silence Button - The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.
   d. Surge Counter - The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.

1) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. A backkup battery may also be utilized in order to achieve this functionality.

6. Overcurrent Protection - The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.
7. Fully Integrated Component Design - All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules may be ganged together in order to achieve higher surge current ratings.
8. Safety Requirements:
   a. The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. Replaceable modules are acceptable. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
   b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

2.3 SYSTEM APPLICATION

A. The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

B. Surge Current Capacity - The minimum surge current capacity the device is capable of withstanding (based on ANSI/IEEE C62.41 location category) shall be as follows:
   1. Category C (Service Entrance Locations - Switchboards, Switchgear, Motor Control Centers, Main Entrance):
      a. Per Phase - 240 kA
      b. Per Mode - 120 kA
   2. Category B (High Exposure Rooftop Locations - Distribution Panelboards):
      a. Per Phase - 160 kA
      b. Per Mode - 80 kA
   3. Category A (Branch Locations - Panelboards, MCCs, Busways):
      a. Per Phase - 120 kA
      b. Per Mode - 60 kA

C. SPD Type - all SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

2.4 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.
   1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.

2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
3. The panelboard shall be capable of re-energizing upon removal of the SPD.
4. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a 30A circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30A circuit breaker.
5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
6. Sidemount Mounting Applications Installation (SPD mounted external to electrical assembly): Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices.

2.5 SWITCHGEAR / SWITCHBOARD, MCC, AND BUSWAY REQUIREMENTS

A. The SPD application covered under this section is for switchgear, switchboard, MCC, and busway locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.
   1. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
   2. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.
   3. The SPD shall be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.
   4. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.6 ENCLOSURES

A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:
   1. NEMA 1 - Constructed of a polymer (units integrated within electrical assemblies) or steel (sidemount units only), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).
   2. NEMA 4 - Constructed of steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure. (sidemount units only).
   3. NEMA 4X - Constructed of stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection. (sidemount units only)

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Surface or Flush Mounted Panelboards with Exterior SPDs: Mount SPDs on the side or bottom of the panelboard, closest to the serving breaker. Make leads as short and straight as possible.

C. Provide multi-pole, 30 Amp breaker as a dedicated disconnect for SPD unless otherwise indicated on drawings. Provide breakers for ALL SPDs.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

3.2 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality control testing:
   1. After installing the Surge Protection Device, but before electrical circuitry has been energized, test for compliance with requirements.
   2. Complete start-up checks and voltage verifications according to manufacturer's written instructions.
   3. Perform visual and mechanical inspection on each unit. Certify that units are installed per manufacturer's recommendations.

B. Repair or replace malfunctioning units. Retest after repairs or replacements are made.

END OF SECTION

SECTION 26 2701

ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Service Requirements

B. Service Voltage Verification

1.2 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.3 SYSTEM DESCRIPTION

A. System Characteristics: 480Y/277 volts, three phase, four-wire, 60 Hertz.

1.4 SUBMITTALS

A. See section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Service Voltage Verification: The Contractor shall provide a letter verifying the availability of indicated voltage from the serving utility company. The letter shall be included in the submittal data. No electrical equipment shall be released for fabrication until such verification has been made.

C. Product Data: Provide ratings and dimensions of transformer cabinets and meter bases.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with utility company written requirements and NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 COORDINATION

A. Services: Secondary service raceway and conductors by contractor. Transformer and primary service shall be provided by the Utility Company. Contractor shall provide transformer pad meeting Georgia Power Company specifications.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Meter Base: Furnished by utility company.

PART 3 EXECUTION

3.1 PREPARATION

A. Arrange with utility company to obtain permanent electric service to the Project.

B. Verify that field measurements are as indicated on utility company drawings.

3.2 INSTALLATION

A. Install transformer pad as required by utility company.

B. Contractor is responsible for all items required for the transformer pad including any additional conduits for metering and/or interpad conduit bank connections.

C. Contractor shall provide underground raceway and conductors to transformer as shown.

D. Contractor shall seal all service entrance conduits to prevent water entry. Seal conduits at the pad mount transformers and inside the switchboard/switchgear.

E. Conduit stub-ups inside primary and secondary compartments of padmount transformers shall be extended minimum 6-inches above pad.

END OF SECTION

SECTION 26 2717

EQUIPMENT WIRING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical connections to equipment.

1.2 RELATED REQUIREMENTS

A. Section 26 0574 - Electrical Testing.

B. Section 26 0534 - Conduit.

C. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables (600 V and Less).

D. Section 26 0537 - Boxes.

E. Section 26 2726 - Wiring Devices.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.4 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.5 COORDINATION

A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

B. Determine connection locations and requirements.

C. Sequence rough-in of electrical connections to coordinate with installation of equipment.

D. General: No roughing shall be done until roughing drawings and exact electrical demand of equipment is obtained. Notify Architect of any discrepancies.
   1. Mechanical:
      a. Review tabulated sheet of Power Wiring Requirements of all Mechanical Equipment specified in Division 23 of Specifications. Conduit, conductor, and breaker sizes shown for mechanical equipment are based upon the best available information on the equipment specified. The Contractor shall be allowed to provide electrical circuits compatible with the proposed mechanical equipment where the mechanical equipment conforms to Division 23 of the specifications, but does not conform to the electrical criteria of these contract documents . The Contractor shall submit the proposed electrical modifications to the Architect for review prior to roughing. No additional costs to the contract will be allowed for these modifications.
      b. Provide 4" thick concrete housekeeping pad beneath any equipment free standing on concrete floor. Pad shall extend 2" on all sides of equipment and shall be beveled 1 inch on all sides.
      c. Provide conduit, wiring, boxes, adaptors for equipment terminations and disconnect switches. Provide power wiring through primary control device.

d. Starters, push-button stations, contactors, relays, limit and safety devices, and control items are specified in DIVISION 23 except as shown in Motor Control Center. Unless otherwise noted, all starters shall be mounted between 24" and 80" above finished floor. Push-button stations shall be mounted at switch height except as noted.

e. Kitchen Equipment, Laboratory equipment, or Shop equipment Make electrical connections to all equipment provided under this contract from outlets shown. Obtain roughing drawings prior to installing any outlets. Notify Architect of any discrepancies between roughing drawings and contract documents. The Contractor shall be allowed to provide electrical circuits compatible with kitchen equipment acceptable to the Architect but not conforming to electrical criteria of these contract documents, but the Contractor shall submit proposed electrical modifications to the Architect prior to roughing. No additional costs to the contract will be allowed for these changes.

f. Kitchen Equipment and Laundry Equipment Review tabulated sheet of Power Wiring Requirements of all kitchen, and laundry equipment. Conduit, conductor, and breaker sizes shown for the equipment are based upon the best available information on the equipment specified. The Contractor shall be allowed to provide electrical branch circuits compatible with the kitchen, and laundry equipment acceptable to the Architect, but not conforming to the electrical criteria of these contract documents . The Contractor shall submit the proposed electrical modifications to the Architect for review prior to roughing. No additional costs to the contract will be allowed for these changes.

g. Owner Furnished Equipment: Provide conduit, wiring, boxes, adaptors for equipment terminations, and disconnect switches. Make all connections indicated.

E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Conform to NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Wiring Devices: As specified in Section 26 2726.

C. Flexible Conduit: As specified in Section 26 0534.

D. Wire and Cable: As specified in Section 26 0519.

E. Boxes: As specified in Section 26 0537.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings. Plug all raceway penetrating freezer/cooler wall with white permagum to prevent moisture condensation.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Device plates and decorative box covers.

D. Floor box service fittings.

E. Poke-through service fittings.

1.2 RELATED REQUIREMENTS

A. Section 26 0537 - Boxes.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Manufacturer's Installation Instructions.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 Manufacturers: Cooper, Hubbell, Leviton, P&S (See below for model numbers.)

A. Substitutions: See Section 01 6000 - Product Requirements.

2.2 WALL SWITCHES

A. Wall Switches: Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
   1. Body and Handle: Ivory plastic with toggle handle. Contractor shall coordinate wiring device color with Architect prior to ordering.
   2. Indicator Light: Lighted handle type switch; red handle.
   3. Ratings:
      a. Voltage: 120 - 277 volts, AC.
      b. Current: 20 amperes .

B. Switch Types: Single pole, 3-way, 4-way, and pilot gang.
   1. Single Pole Switches:

a. Cooper 2221
b. Hubbell HBL1221
c. Leviton 1221-2
d. P&S PS20AC1

2. 3-Way Switches:
a. Cooper 2223
b. Hubbell HBL1223
c. Leviton 1223-2
d. P&S PS20AC3

3. 4-Way Switches:
a. Cooper 2224
b. Hubbell HBL1224
c. Leviton 1224-2
d. P&S PS20AC4

4. Pilot Gang (provide for lighting control of all Janitor's closets, closets, and storage spaces where the switch is located outside the space):
a. Cooper 2221PL
b. Hubbell HBL1221PL
c. Leviton 1221-PL
d. P&S PS20AC1-RPL7

5. Key:
a. Cooper 2221L
b. Hubbell HBL1221L
c. Leviton 1221-2L
d. P&S PS20AC1-L

2.3 RECEPTACLES

A. Receptacles: Heavy duty type.
1. Device Body: Ivory plastic. Contractor shall coordinate wiring device color with Architect prior to ordering.

B. Convenience Receptacles: Type 5 - 20.

C. Outlet Types:
1. Duplex Convenience Receptacles.
a. Cooper 5362
b. Hubbell HBL5362
c. Leviton 5362
d. P&S 5362-A

2. GFCI Receptacles: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements. Devices shall be UL943 Compliant.
a. Cooper XGF20
b. Hubbell GF5362
c. Leviton 8898
d. P&S 2095

3. Isolated Ground Receptacles:
a. Cooper IG5362
b. Hubbell IG5362
c. Leviton 5362-IG
d. P&S IG6300

4. Dryer Receptacle (NEMA 14-30):
a. Cooper 1257
b. Hubbell HBL9430A
c. Leviton 278
d. P&S 3864

5. Range Receptacle (NEMA 14-50):
   a. Cooper 1258
   b. Hubbell HBL9450A
   c. Leviton 279
   d. P&S 3894

2.4 WALL PLATES

A. General:
   1. Size: Plates shall be jumbo size, except as noted on plans or specified herein.
   2. Finish: Satin Stainless Steel, except as noted on plans or specified herein.

B. Weatherproof Cover Plates: Clear Polycarbonate "While-In-Use" style with hinged cover, the integrity of which shall not be affected when the attachment plug cap is inserted or removed.

2.5 FLOOR MOUNTED SERVICE FITTINGS

A. Flush Cover Convenience Receptacles:
   1. Material: Brass.
   2. Configuration: Duplex flap opening.

B. Flush Cover Communication Outlets:
   1. Material: Brass.
   2. Configuration: 2-1/8 inch x 1 inch combination threaded opening.

C. Flush Cover Combination Fittings:
   1. Material: Brass.
   2. Configuration: Duplex flap opening with 2-1/8 inch x 1 inch combination threaded opening.

D. Protective Ring: Brass finish.

E. Split Nozzles: Brass finish.

F. Carpet Rings: Brass.

2.6 POKE-THROUGH FITTINGS

A. Manufacturers:
   1. Hubbell Wiring Devices - Kellems; Model _____: www.hubbell-wiring.com.
   2. Thomas & Betts Corporation; Model _____: www.tnb.com.
   3. Wiremold Company; Model _____: www.wiremold.com.

B. Poke-Through Fittings: Assembly comprising service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination.
   1. Fire Rating: 3 hours.
   2. Type: Flush.
   3. Housing: Satin aluminum.
   4. Device Plate: Stainless steel.
   5. Configuration: As indicated on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that outlet boxes are installed at proper height.

B. Verify that wall openings are neatly cut and will be completely covered by wall plates.

C. Verify that floor boxes are adjusted properly.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install devices plumb and level.

B. Install switches with OFF position down.

C. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

D. Install receptacles with grounding pole on bottom.

E. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

F. Install wall plates on switch, receptacle, and blank outlets.

G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

H. Connect wiring devices by wrapping conductor around screw terminal.

I. Install plates with all edges in contact with the finished wall.

J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

K. Mount all plates vertically unless otherwise noted.

L. Where two or more devices are shown adjacent, they shall be mounted in ganged boxes and covered with one faceplate.

M. Install protective rings on active flush cover service fittings.

N. Where outlets of different levels are shown adjacent, they shall be installed in one vertical line. Outlets shown back to back on a common wall shall be offset a minimum of 10 inches to dampen sound transmission through the wall.

O. On all acoustical walls and walls with 1 hour or greater fire rating, "back to back" outlets shall be installed a minimum of 24 inches apart. Mount with stud between outlets for gypboard constructed partitions.

P. Where outlets are installed in unfinished block or tile partitions they shall be installed at the points in the tile to permit the face plate to cover the rough opening. The horizontal and vertical locations indicated may be altered to permit above installation. Contractor shall check the Architectural drawings to prevent conflicts when shifting locations.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 0537 to obtain mounting heights specified.

B. Where the mounting height of an outlet is not shown on the plans or specifications, the contractor shall contact the Architect for exact mounting height requirements.

3.5 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity prior to final inspection.

E. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 2813

FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fuses.

1.2 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.3 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

1.4 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.5 MAINTENANCE MATERIALS

A. Furnish three of each size and type fuse installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

2.2 Manufacturers: Bussman, G.E., Ferraz Shawmut, Economy, Cefco, Cutler Hammer.

2.3 FUSES - GENERAL

A. Use only fuses of voltage, amperage and class compatible with fuse holder or disconnect.

B. Voltage: Rating suitable for circuit phase-to-phase voltage.

C. Disconnect Switches: 208 or 240V system U.L. Class RK-5, 250 volt rating with minimum interrupting capacity of 200,000 symmetrical amperes.

D. Disconnect Switches: 277/480V or 600V systems U.L. Class RK-5, 600 volt rating with minimum interrupting capacity of 200,000 symmetrical amperes.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide fuses in all fused devices. This shall include equipment of other trades.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

SECTION 26 2817

ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed circuit breakers.

1.2 RELATED REQUIREMENTS

A. Section 26 0574 - Electrical Testing.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide catalog sheets showing ratings, trip units, time current curves, dimensions, and enclosure details.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 MANUFACTURES: General Electric, Square D, Cutler-Hammer, ITE/Siemens Allis.

2.2 MOLDED CASE CIRCUIT BREAKERS

A. Circuit Breakers: NEMA AB 1.
   1. Enclosure shall be NEMA 1 rated for indoor applications and NEMA 3R where exposed to weather.
   2. Provide with non-teasible, positive, quick-make, quick-break mechanisms.
   3. Minimum interrupting capacity (UL and NEMA) shall match that of the next panelboard upstream.

2.3 ACCESSORIES

A. Enclosures:
   1. Fabricate enclosures from steel.
   2. Finish: Manufacturer's standard enamel finish, gray color.

B. Handle Lock: Include provisions for padlocking.

C. Provide mechanical trip device.

D. Provide grounding lug in each enclosure.

E. Provide products suitable for use as service entrance equipment where so applied.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install enclosed circuit breakers where indicated, in accordance with manufacturer's instructions.

B. Install enclosed circuit breakers plumb. Provide supports in accordance with Section 26 0529.

C. Maximum mounting height to operating handle shall be 6 feet (1.9 M).

D. Provide engraved plastic nameplates under the provisions of Section 26 0553.

3.2 FIELD QUALITY CONTROL

A. Inspect and test each circuit breaker.

B. Inspect each circuit breaker visually.

C. Perform several mechanical ON-OFF operations on each circuit breaker.

D. Verify circuit continuity on each pole in closed position.

3.3 ADJUSTING

A. Adjust trip settings so that circuit breakers coordinate with other overcurrent protective devices in circuit.

B. Adjust trip settings to provide adequate protection from overcurrent and fault currents.

END OF SECTION

SECTION 26 2818

ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fusible switches.

B. Nonfusible switches.

1.2 RELATED REQUIREMENTS

A. Section 26 0574 - Electrical Testing.

B. Section 26 2813 - Fuses.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Product Data: Provide switch ratings and enclosure dimensions.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS: General Electric, Square D, Cutler-Hammer, ITE/Siemens Allis.

2.2 COMPONENTS

A. Fusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch (H.P. Rated).
   1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
   2. Handle and switching mechanism integral with switch base, with easily recognizable position and lockable in OFF position.
   3. Visible blades.
   4. Non-teasible, positive, quick-make, quick-break mechanism.
   5. Line terminal shields.
   6. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses.

B. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch (H.P. Rated).
   1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
   2. Handle and switching mechanism integral with switch base, with easily recognizable position and lockable in OFF position.
   3. Visible blades.
   4. Non-teasible, positive, quick-make, quick-break mechanism.
   5. Line terminal shields.

C. Enclosures: NEMA KS 1.
   1. Interior Dry Locations: Type 1.
   2. Exterior locations: Type 3R
   3. _____ Locations: Type ____.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install fuses in fusible disconnect switches.

C. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

END OF SECTION

SECTION 26 4113

LIGHTNING PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air terminals and interconnecting conductors.

B. Grounding and bonding for lightning protection.

1.2 RELATED SECTIONS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems

1.3 REFERENCES

A. NFPA 780 - Standard for the Installation of Lightning Protection Systems; National Fire Protection Association; 2004.

B. UL 96 - Lightning Protection Components; Underwriters Laboratories Inc.; 2005.

C. UL 96A - Installation Requirements for Lightning Protection Systems; Underwriters Laboratories Inc.; 2001.

D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.4 SYSTEM DESCRIPTION

A. Lightning Protection System: Conductor system consisting of air terminals on roofs; bonding of structure and other metal objects; grounding electrodes; and interconnecting conductors.

1.5 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Shop Drawings: Indicate layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.

C. Product Data: Provide dimensions and materials of each component, and include indication of testing agency listing.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Project Record Documents: Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors in project record documents.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 780 and UL 96A and provide UL Certified System.

B. Maintain one copy of each document on site.

C. Products: Furnish products listed and classified by testing agency acceptable to authority having jurisdiction as complying with UL 96.

D. Manufacturer Qualifications: Company specializing in lightning protection equipment with minimum three years documented experience.

E. Installer Qualifications: Authorized installer of manufacturer with minimum three years documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Lightning Protection:
   1. Harger Lightning and Grounding.
   2. East Coast Lightning Equipment (ECLE).
   3. Robbins Lightning, Inc.
   4. Heary.

2.2 COMPONENTS

A. Air Terminals: Copper, solid.
   1. Terminals shall not be less than 15 inches in height.
   2. The terminal shall taper to a point.
   3. The terminal below the taper shall be 1/2 inches in diameter.
   4. Terminals more than 18 inches in height shall be supported by a brace, with guides, not less than one-half the height of the air terminal.

B. Grounding Rods: Solid copper.
   1. Diameter: Minimum 5/8 inches.
   2. Length: Minimum 10 feet.

C. Conductors: Copper cable, of weight and size necessary to achieve system certification. Aluminum conductors may be utilized as necessary to prevent dissimilar metals interaction.

D. Connectors and Splicers: Bronze.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Coordinate work with roofing and exterior and interior finish installations.

3.2 INSTALLATION

A. Install in accordance with NFPA 780 and UL 96A.

B. Connect conductors using mechanical connectors. Protect adjacent construction elements and finishes from damage.

C. Bond exterior metal bodies on building to lightning protection system.

D. Integral System on Steel Frame:
   1. The steel framework or reinforcement shall be made electrically continuous.
   2. Electrical continuity may be provided by bolting, riveting, or welding steel frame and by tying, clipping, or welding reinforcing bars.
   3. The air terminals shall be securely attached to the structural steel frame. Air terminals placed on top of parapet walls shall be secured using adhesive rated for this purpose.
   4. Short runs of conductors may be necessary to join air terminals to the metal framework so that proper placing of air terminals is maintained.
   5. Separate down conductors from air terminals to ground connections are not required.
   6. Where a water system enters the building, the structural steel or reinforcing framework and the water system shall be securely connected at the point of entrance by a ground conductor.
   7. Connections to pipes and reinforcing bars shall be by means of substantial ground clamps with lugs.
   8. Connections to structural framework shall be by means of nut and bolt or welding.

9. All connections between columns and ground connections shall be made at the bottom of the columns.

E. Provide down conductors as required.

F. Spacing between down conductors shall not exceed 60 feet.

G. Down conductors shall be routed concealed in partitions, chases, or furring around columns.

H. In each perimeter cast-in-place concrete column, provide a 1" PVC conduit continuous from the column top to below grade, for down conductor installation.

3.3 FIELD QUALITY CONTROL

A. Obtain the services of Underwriters Laboratories, Inc. to provide inspection and certification of the lightning protection system.

B. Provide copy of the UL Inspection Certificate.

END OF SECTION

SECTION 26 5100

INTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires and accessories.

B. Ballasts.

C. Fluorescent lamp emergency power supply.

D. Lamps.

1.2 REFERENCE STANDARDS

A. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

C. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2000.

1.3 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.4 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and NFPA 101.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 LUMINAIRES

A. Furnish products as indicated in this Schedule and as included on the Drawings.
   1. Surface and recessed luminaires shall be constructed of not less than 22 gauge die formed, embossed or ribbed steel with enclosed ballast and wiring compartments.
   2. Metals shall be treated to provide a permanent bonded surface resistant to corrosion. Painted surfaces shall be finished with baked enamel having a reflectance value of at least 85 percent.

B. All recessed lighting fixtures shall have internal thermal protection in accordance with the Underwriters' Laboratory listing criteria for the ceiling system in which the fixtures are being installed.

C. Each luminaire shall bear the label of Underwriter's Laboratories (UL).

D. The contractor shall verify all voltages to fixtures and shall furnish fixtures, ballasts, etc. compatible with voltages from panels serving fixtures.

E. Metals shall be treated to provide a permanent bonded surface resistant to corrosion. Painted surfaces shall be finished with baked enamel having a reflectance value of at least 85%.

F. For fluorescent fixtures used in classrooms, media centers, and instructional areas:
   1. Overall fixture efficiency shall be a minimum of 55% of bare lamp output.
   2. Brightness shall be measured using specified lamps.
   3. Bare lamps shall not be visible above the 45 degree viewing angle, crosswise or lengthwise.
   4. Minimum Visual Comfort Probability (VCP) for all fixtures located in classroom type instructional areas and media centers shall be 70%.

G. Manufacturers names and series are shown to indicate the general type fixture and quality. The functional and material criteria of the specifications for the fixture "types" shall take precedence and no fixture shall be provided which does not comply with the criteria. Listing of a manufacturer does NOT constitute a waiver of ANY of the functional and material criteria.

2.2 BALLASTS AND CONTROL UNITS

A. Fluorescent Ballasts: ANSI C82.1, high power factor type electromagnetic ballast, suitable for lamps specified.
   1. Voltage: See Lighting Fixture Schedule on plans.
   2. Certify fluorescent ballast design and construction by Certified Ballast Manufacturers, Inc.
   3. Ballasts shall be instant start, high output, electronic type.
   4. Ballasts shall be parallel type so that only the failed lamp goes out with remaining lamps on the ballast continuing to operate.
   5. Ballasts shall not exceed 70 degree Celsius case operating temperature.
   6. Ballasts shall start and operate from a supply voltage of plus or minus 10 percent of 120 or 277 volts as indicated.
   7. Lamp current crest factor shall be 1.7 or less as per lamp manufacturer's recommendation.
   8. Ballasts shall have a power factor greater than 0.90.
   9. Ballasts shall be furnished consistent with the lamps specified.
   10. Ballasts shall have a GOOD sound rating ("A" Rating).
   11. The total harmonic distortion generated by the ballast shall be less than 10%.
   12. Ballasts shall contain no PCB's and shall be thermally protected.
   13. Ballasts shall be Single, Two, Three or Four lamp units. Provide multiple ballasts in fixtures where multi-level switching is indicated on drawings so that 3 an 4 lamp fixtures are switched "inboard-outboard".
   14. Each fixture shall contain one ballast except where " inboard-outboard " switching is indicated on the drawings.
   15. Ballast factor shall exceed 0.88 for two lamps and 0.85 for four lamps.
   16. Ballasts for compact fluorescent shall be rated for operation at 80 C; shall be potted; and shall be encased. Ballasts shall be provided with heat sinks or ventilation means in order to maintain an ambient operating environment for the ballast of less than 70 C. Test results shall be furnished on demand.
   17. All Fluorescent fixtures shown to be dimmed shall be furnished with dimming ballasts and controller(s) of the same manufacturer.
   18. Manufacturers: Magnetek, Motorola, Advance, Osram/Sylvania.

B. High Intensity Discharge (HID) Ballasts: ANSI C82.4, metal halide lamp ballast, suitable for lamp specified.
   1. See lighting Fixture Schedule on the drawings for ballast voltage.
   2. High Intensity Discharge Ballasts: High Power factor with thermal protection.
   3. Ballasts shall have a GOOD sound rating ("A" Rating).

4. Manufacturers: Magnetek, Motorola, Advance, Osram/Sylvania.

C. All recessed lighting fixtures shall have internal thermal protection in accordance with the Underwriters' Laboratory listing criteria for the ceiling system in which the fixtures are being installed.

D. Fluorescent Lamp Emergency Power Supply: Emergency battery power supply suitable for installation in ballast compartment of fluorescent luminaire.
1. Self-contained emergency lighting unit shall provide automatic illumination of lamps for a minimum of 90 minutes emergency service upon failure or interruption of normal power. Unit shall be U.L. Listed. Housing shall be constructed of 18-gauge steel and finished with corrosion-resistant beige enamel. Emergency power source shall be a 12-volt rechargeable, maintainable, Nickel-Cadmium battery. Electronics shall be of digital solid state design and include low-voltage battery disconnect, short circuit and thermal protection, a constant voltage transformer, a full-wave voltage and current regulator with maximum 8-amp charge current and light emitting diodes that indicate operation or charge mode. Unit shall be rated 120/277 volt, 60 Hz. Controls shall include a test switch, L.E.D. "Power On" indicator and red "Fast Charge" indicators. Unit shall provide MINIMUM 1100 lumen output for a single lamp for the above listed time span.
2. Include TEST switch and AC ON indicator light, installed to be operable and visible from the outside of an assembled luminaire.
3. Manufacturers: Emergi-Lite, Bodine, Dual-Lite, Chloride/Exide, Lithonia, Cooper-SureLite.

2.3 LAMPS

A. Manufacturers:
1. GE Lighting: www.gelighting.com.
2. Philips Lighting Co of NA: www.lighting.philips.com.
3. Sylvania

B. General: Provide for all fixtures. Fixtures shall be left clean and lamps burning at final inspection. All metal halide and mercury vapor lamps shall be equipped with self extinguishing mechanisms to extinguish the arc if the outer globe is broken.

C. Incandescent: 130 volt type as scheduled on plans. Frosted lamps except as noted.

D. Tungsten Halogen: Clear 130V type as scheduled on the plans.

E. Compact Fluorescent: Lamps as noted elsewhere, minimum color rendering index of 82, 3500K color temperature.

F. Fluorescent Lamps:
1. T-8 Fluorescent Lamps: All 24-inch, 36-inch, 48-inch, and 96-inch lamps shall be T8 fluorescent lamps, nominally 32 watts with 2950 minimum initial lumens for the 48 inch lamps, minimum color rendering index of 82, 3500K color temperature. Lamps shall be low mercury content with less than 10 milligrams of mercury per 48-inch lamp.
2. Manufacturers: General Electric, Phillips, Osram/Sylvania, ITT.

G. High Intensity Discharge (HID) Lamps:
1. Mercury Vapor: Deluxe White.
   a. Lamps shall be equipped with self extinguishing mechanisms to extinguish the arc if the outer globe is broken.
2. Metal Halide: Deluxe white phosphor coated.
   a. Lamps shall be equipped with self extinguishing mechanisms to extinguish the arc if the outer globe is broken.
3. High Pressure Sodium: Clear Lamps.
4. High Pressure Sodium: Clear Lamps with standby arc tube.
5. Manufacturers: General Electric, Phillips, Osram/Sylvania, ITT.

H. All recessed lighting fixtures shall have internal thermal protection in accordance with the Underwriters' Laboratory listing criteria for the ceiling system in which the fixtures are being installed.

I. The contractor shall verify all voltages to fixtures and shall furnish fixtures, ballasts, etc. compatible with voltages from panels serving fixtures.

J. Reflector Lamps: Beam patterns in accordance with ANSI C78.379.
   1. Manufacturers: General Electric, Phillips, Osram/Sylvania, ITT.

2.4 METAL HALIDE ARC TUBE CONTAINMENT

A. Metal Halide fixtures shall contain the arc and failed arc tube particles (if any) by one of the following means:
   1. Metal Halide fixtures shall contain thick-glass parabolic reflector (PAR) lamps.
   2. Metal Halide fixtures shall have a containment barrier enclosing the lamp or failed lamp particles if the lamp is other than a Type "O" lamp. A Type "O" lamp may also be utilized in a fixture having a containment barrier.
   3. Open type Metal Halide fixtures shall contain a Type "O" lamp.

B. Type "O" rated lamps shall meet the ANSI containment test for installation of the Metal Halide lamp in an open fixture.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 and 502.

B. The contractor shall verify all voltages to fixtures and shall furnish fixtures, ballasts, etc. compatible with voltages from the panelboards serving the fixtures.

C. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

D. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

E. Suspension: The contractor shall verify all ceiling types and configuration prior to ordering fixtures and shall furnish fixtures compatible with the ceilings being installed. Mounting information shown on the lighting fixture schedule is based upon the best information available during design, but must be verified by the contractor upon receipt of ceiling submittals and modifications made to assure ceiling/light fixture compatibility.
   1. Grid Troffers: Omit hangers and fasten to inverted tees with holddown clips. For installation in the narrow flanged grid system, two sheet metal screws shall be installed in the ends of the fixture penetrating the spline of the grid member. The fasteners shall be installed inside the fixture housing and shall be concealed. Provide two minimum 18 gauge galvanized steel hangar wires from diagonal corners of each fixture to structure.
   2. Surface & Recessed Incandescent: For ceiling support systems with members 2-feet on center, use fixture support brackets supplied by manufacturer. Where no bracket is supplied by manufacturer and where span exceeds 2-feet, provide two 1 5/8" x 7/8" x 12 gauge minimum channels spanning ceiling supports except as noted. Secure fixture supports to ceiling supports with 18 gauge stainless steel wire ties.
   3. Surface Fluorescent and Recessed HID: Support from structural system with two 3/8-inch threaded rods unless otherwise noted. Use nut and locknut to secure fixture. For fixtures not connected with flexible conduit, the contractor shall verify exact location of fixture knockouts and wireway prior to roughing outlet box.
   4. Recessed Flanged Troffers in Hard Ceilings: Support from structural system with two 3/8-inch threaded rods except where the suspended ceiling system includes a suspended structural channel support system to which fixture attached channel clamps may be attached.

5. Suspended Fluorescent: Support on 1/2 or 3/4 inch stems OR aircraft cable as shown on the Lighting Fixture Schedule. Stems shall have a swivel canopy and shall not be less than 8 inches in length. Fixtures shall be supported from the structure. No fixtures shall be chain supported unless specifically indicated on the plans.
6. Suspended Mercury Vapor or Metal Halide: See Details on plans.
7. Locating Light Fixtures in Mechanical Equipment Spaces: The contractor shall adjust lighting fixture locations to avoid conflicts between fixtures, ducts, pipes, and equipment. Locate light fixtures below and clear of ducts, pipes and equipment, but fixtures shall not be mounted less than 7 feet above the finished floor, nor more than 12 feet above the floor. Suspend fixtures via 1/4" threaded rod from each end of fixture.

F. Structural System Attachments:
1. Poured-in Place Concrete or Precast Solid Masonry: Concrete expandable anchors unless otherwise noted.
2. Steel Bar Joists or Steel Beams: 1 5/8-inch x 3/4-inch x 12 gauge channel bolted to top chords. Drill channel and secure threaded rod to channel with nut and locknut unless otherwise noted.
3. Along Bar Joist or Steel Beam Center Line: F & M Fig. 255, Grinnell Fig. 88, or Elcen Fig. 29 beam clamps unless otherwise noted.

G. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

H. Install recessed luminaires to permit removal from below.

I. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

J. Install clips to secure recessed grid-supported luminaires in place.

K. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Drawings.

L. Install accessories furnished with each luminaire.

M. Connect luminaires to branch circuit outlets provided under Section 26 0537 as indicated.

N. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

O. Bond products and metal accessories to branch circuit equipment grounding conductor.

P. Install specified lamps in each luminaire.

Q. All 3 and 4 lamp fluorescent lighting fixtures on a common circuit and shown with multiple switches shall have the two outside lamps switched by one switch and the remaining lamp(s) switched separately except where otherwise noted. Provide multiple ballasts for multi-level switching as required. Use all two lamp ballasts in a tandem wiring configuration where possible. One two lamp ballast will control the outer lamps in a 3 lamp fixture. The second two lamp ballast will control the center lamp plus the center lamp in the adjacent fixture.

3.2 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

A. Aim and adjust luminaires as directed.

B. Position exit sign directional arrows as indicated.

3.4 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosures.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.5 CLOSEOUT ACTIVITIES

A. Demonstrate luminaire operation for minimum of two hours.

3.6 PROTECTION

A. Relamp luminaires that have failed lamps at Substantial Completion.

3.7 SCHEDULE - See Drawings

END OF SECTION

SECTION 26 5200

SENSOR LIGHTING CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Occupancy Sensors.

B. Indoor Daylight Light Level Controllers.

C. Outdoor Type Photoelectric Switches.

1.2 RELATED SECTIONS

A. Section 26 5100 - Interior Lighting.

B. Section 26 5600 - Exterior Lighting.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.4 SYSTEM DESCRIPTION

A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.

B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

1.5 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Product Data: Provide product data sheets for all equipment to be used. Provide circuit diagrams of each type of device. Circuit diagrams shall indicate type of control wire and/or line voltage wire used.

C. Shop Drawings: Indicate layout of each interior space showing proper placement and aiming of occupancy sensor shown on the plans. Notify the the Architect immediately of any possible conflicts with equipment / room layout shown on the plans. These drawings shall be produced using a CAD based program and submitted on full size (minimum "D" size) prints.

D. Product data shall clearly indicate method used to handle inrush current for all wall switch products.

E. Product data shall clearly state any load restrictions when used with electronic ballasts.

F. Project Record Documents: Record actual locations of installed sensors and controls. Drawings shall include location of all power packs and low voltage wiring.

1.6 QUALITY ASSURANCE

A. The Contractor shall schedule an onsite meeting with an authorized factory agent to instruct the Contractor in proper mounting, adjustments and aiming of the occupancy sensors. This meeting shall take place prior to start of sensor installation.

B. Perform work in accordance with NFPA 70.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

D. All products shall be from the same manufacturer.

E. All components shall be U.L. listed.

F. Products shall be manufactured by an ISO 9002 certified manufacturing facility.

G. Wall switch products shall be capable of withstanding the effects of inrush current.

1.7 WORK INCLUDED

A. The Contractor shall provide all labor, materials, tools, appliances, control hardware, sensors, wiring, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as shown on the plans and as described herein.

B. The Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, luminaires, HVAC systems and building management systems.

1.8 WARRANTY

A. Provide five year manufacturer warranty for all components.

B. Any equipment found to be damaged, defective or non-conforming shall be replaced at no additional cost to the owner.

1.9 EXTRA MATERIALS

A. Supply two additional power packs and one additional sensor of each type used for the Owner's use in maintenance of project.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Occupancy Sensors:
   1. The WattStopper
   2. Leviton
   3. Hubbell
   4. Pass & Seymour
   5. Lutron
   6. Lightolier
   7. Novitas

B. Outdoor Type Photoelectric Switches:
   1. Paragon
   2. Tork
   3. Intermatic
   4. Precision
   5. Ripley

2.2 OCCUPANCY SENSORS

A. The passive infrared sensors shall be capable of detecting presence, in the control area, by detecting changes in the Infrared energy. Small movements shall be detected such as when a person is writing while seated at a desk.

B. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

C. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.

D. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have a 180 degree coverage capability.

E. Wall switch sensors shall include means of protecting the internal relay from the effects of inrush current.

F. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.

G. If an open circuit occurs in the AC line (such as a ballast or lamp failure), the sensor shall automatically switch to OFF mode.

H. In the event of a sensor failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain ON constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.

I. Wall switch sensor shall have 2 positions only, OFF and AUTO, for normal operation.

J. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.

K. Where specified, vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0mm thickness. Products utilizing a soft lens will not be considered.

L. Passive infrared sensors shall have a multiple segmented Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up. The lens shall filter short wavelength IR such as those emitted by the sun and other visible light sources.

M. Ultrasonic sensing shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and airflow throughout controlled space.

N. Ultrasonic operating frequency shall be crystal controlled to within plus or minus 0.01% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.

O. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound will not be considered.

P. For dual technology sensors, detection verification of BOTH technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting on.

Q. Dual technology sensors shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off.

R. All sensors used in the center of a space shall provide for 360 degrees of coverage.

S. Sensors shall be capable of being wired in parallel to allow coverage of large areas.

T. To avoid false ON activations and to provide high sensitivity to minor motion, Pulse Count Processing and Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.

U. Sensor shall incorporate field-selectable logic configurations which allows for space utilization changes and/or other special field conditions.

V. Where specified, passive infrared and dual technology sensors shall offer daylighting foot candle adjustment control and be able to accommodate dual level lighting.

W. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.

X. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

Y. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

Z. Where specified, sensor shall have an internal, additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

2.3 CIRCUIT CONTROL HARDWARE (POWER PACKS)

A. Control units shall be capable of external mounting through a 1/2" knock-out on a standard electrical enclosure. Unit shall be rated for plenum installation.

B. The control unit shall be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to power the sensor.

C. Each control unit shall be capable of powering a minimum of two occupancy sensors.

D. Relay contacts shall have ratings of:
1. 13A - 120 VAC Tungsten
2. 20A - 120 VAC Ballast
3. 20A - 277 VAC Ballast

E. Control wiring between sensors and control units shall be Class II, 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums.

F. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

2.4 INDOOR DAYLIGHT LIGHT LEVEL CONTROLLER

A. Provide indoor daylight light level controllers where shown and preset to footcandle level at 40-foot candles.

B. The light level controller shall be capable of detecting changes in lighting levels. The light level controller shall utilize an internal photo conductive cell to measure light levels.

C. The light level controller shall be capable of controlling any type of lighting. It shall be a self contained device. Unit shall contain power supplies, contacts and all accutrements to control one 20 ampere lighting circuit(s). Unit power shall be derived from the lighting branch circuit.

D. The light level controller shall be capable of turning lighting on and off between 10 and 200 footcandles for low lighting levels and between 50 and 1000 footcandles for brighter areas.

E. The light level controller shall have an adjustable deadband feature with a 1 to 3 ratio to prevent the cycling of lighting with minor lighting level changes.

F. The light level controller shall have an adjustable time delay range of 3 seconds to 5 minutes minimum to prevent cycling on and off during momentary lighting changes.

G. The light level controller shall have LED's to indicate the status of the sensor.

H. Each sensor shall be furnished with a by-pass provision to enable override of the sensor in case of a failure. Sensor shall have a minimum 5 year warranty.

2.5 OUTDOOR TYPE PHOTOELECTRIC SWITCH

A. Photoelectric switch shall be single pole, single throw, with hot/neutral/switched conductors. Switch shall be rated 20 amps. Switch shall be weatherproof, designed for temperature range of -30F to +140F.

B. PE switch shall turn on at 1.5 footcandles and off at 10 footcandles. PE switch shall contain a 20 second time delay.

C. PE switch shall fail with the switch closed.

D. Mount the PE switch facing generally north, adjusted to avoid interaction with nearby artificial lighting. Nipple the PE switch to hole in cast fixture or box with double locknuts and double gaskets. Mount PE switch to a box hub with sealant. Provide a waterproof installation.

E. Where PE switch is mounted on top of a building, provide a cast FS box with conduit hubs. Orient the box with side opening gasketed WP lid, with PE switch on top, and homerun conduit out the bottom. Seal the conduit entries into the box. Duct-seal the homerun from inside the box.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Locate and aim sensors to provide complete and proper volumetric coverage within the manufacturer's specified range of coverage.

C. Spaces shall have 90% - 100% coverage to completely cover the controlled area, accommodating all occupancy habits of single or multiple occupants at any location within the room(s).

D. The location of sensors shown on the plans are diagrammatic only. Locate sensors to avoid interference with possible obstructions.

E. Locate sensors a minimum of 6 feet from and HVAC supply diffuser or return grille.

F. Provide all power/switch packs required to make the system fully functional. Usually, a minimum of one power/switch pack is required per circuit and/or area of control. However in some cases additional power/switch packs may be required. Contact manufacturer for final determination of power/switch packs required for this project.

G. Locate power/switch packs on wall above ceiling directly over the standard wall switch where possible.

H. Wall switches shown in spaces with occupancy sensors shall be wired to override the sensor so that the lights can be switched off manually.

I. In spaces shown with multiple sensors, wire the sensors in parallel so that either sensor can control all of the fixtures on that circuit.

J. Mount ceiling type devices in the center of a ceiling tile.

3.2 STARTING EQUIPMENT AND SYSTEMS

A. Occupancy Based Lighting Control - System Commissioning:
   1. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system.
   2. The Contractor shall provide both the manufacturer and the Architect a written notice of the scheduled commissioning date at least 15 working days prior to the scheduled date.

3. Upon completion of the system fine tuning the factory authorized technician shall provide proper training to the Owner in the adjustment and maintenance of the sensors.
4. The Contractor shall provide all lifts and/or ladders and one technician to assist in the commissioning.
5. Prior to commissioning, the Contractor shall verify that all sensors and associated power supplies/relays are installed and all wiring properly terminated.
6. The manufacturer's factory authorized technician shall, upon completion of the commissioning, provide a written report to the Contractor and the Architect indicating completion of the work. This report shall also indicate any corrective actions required on the part of the Contractor.

END OF SECTION

SECTION 26 5600

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior luminaires and accessories.

1.2 REFERENCE STANDARDS

A. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; 2006.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 with 2009 Georgia State Amendments.

1.3 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.4 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.5 COORDINATION

A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

PART 2 PRODUCTS

2.1 LUMINAIRES

A. Furnish products as indicated in Schedule included on the Drawings.

2.2 BALLASTS

A. Fluorescent Ballasts: ANSI C82.1, high power factor type electromagnetic ballast, suitable for lamps specified.
   1. Provide low-temperature ballast suitable for lamps specified.
   2. Certify fluorescent ballast design and construction by Certified Ballast Manufacturers, Inc.

B. High Intensity Discharge (HID) Ballasts: ANSI C82.4, metal halide lamp ballast, suitable for lamp specified.

C. See Section 26 5100 - Interior Lighting, for additional ballast requirements.

2.3 LAMPS

A. Manufacturers:
   1. GE Lighting: www.gelighting.com.
   2. Philips Lighting Co of NA: www.lighting.philips.com.
   3. Sylvania Lighting

B. Lamp Types: As specified for each luminaire.

C. See Section 26 5100 - Interior Lighting, for additional ballast requirements.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 501.

B. Provide concrete bases for lighting poles at locations indicated, in accordance with Section 03 3000.

C. Install lamps in each luminaire.

D. Bond luminaires, metal accessories, and metal poles to branch circuit equipment grounding conductor. Provide supplementary grounding electrode at each pole.

3.2 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

3.3 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosure.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.4 CLOSEOUT ACTIVITIES

A. Relamp luminaires that have failed lamps at Substantial Completion.

END OF SECTION

SECTION 27 1005

STRUCTURED CABLING FOR VOICE AND DATA - INSIDE-PLANT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Telecommunications service entrance to building(s).

B. Cabling and pathways inside building(s).

C. Cabling and pathways connecting building(s).

D. Distribution frames, cross-connection equipment, enclosures, and outlets.

E. Grounding and bonding the telecommunications distribution system.

F. Administration and Labeling

G. Testing

1.2 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems: Electrical system grounding and bonding.

C. Section 26 0529 - Hangers and Supports

D. Section 26 0534 - Conduit.

E. Section 26 0536 - Cable Trays for Electrical Systems.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; 2008 with 2009 Georgia State Amendments.

B. TIA/EIA-568-B.1 - Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements; Rev B, 2001; Addenda 1-7.

C. TIA/EIA-568-B.2 - Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components; Rev B, 2001; Addenda 1-11.

D. TIA/EIA-568-B.3 - Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling Components Standard, and Addendum 1 - Additional Transmission Performance Specifications for 50/125 um Optical Fiber Cables; Rev B, 2000; Addendum 1.

E. TIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev B, 2004.

F. TIA/EIA-606 - Administration Standard for the Telecommunications Infrastructure; Rev A, 2002.

G. ANSI/J-STD-607 - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications; Rev A, 2002.

H. GTDM - State of Georgia Telecommunications Design Manual; latest edition.

1.4 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Storage and handling requirements and recommendations.
   2. Installation methods and instructions.

B. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

C. Shop Drawings shall also include outlet numbering and identifier assignments.

D. Manufacturer Qualifications.

E. Test Plan: Complete and detailed plan, with list of test equipment, procedures for inspection and testing, and intended test date; submit at least 60 days prior to intended test date.

F. Field Test Reports.

G. Test results verifying that all equipment has been tested for compatibility as part of a structured cabling system.

H. Project Record Documents (shall be prepared and approved by a RCDD):
   1. Provide copy of all approved submittals.
   2. Provide full size as-built drawings (minimum "D" size).
   3. As-built drawings shall accurately record location of service entrance conduit, termination backboards, outlet boxes, cable raceways, cable trays, pull boxes, and equipment racks electronically and on full size prints.
   4. The LVLTC shall prepare 11"X17" as-built serving zone drawings for each Telecommunications Room (TR). The drawings shall be laminated, framed and secured to the wall in the Main Equipment Room (MER) and Telecommunications Room (TR).
   5. Provide copy of all test reports.
   6. Copper cable records shall include the status of each copper pair. Optical fiber cable records shall include strand allocation, test results, and identification of media and protocol used.
   7. Record actual locations of outlet boxes and distribution frames.
   8. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
   9. Identify distribution frames and equipment rooms by room number on contract drawings.
   10. Provide three copies, complete and bound.
   11. Provide copies of all manufacturer's warranties.

I. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

J. Other Required Project Information (To be provided prior to Pre-Final of the building, for each of the specified media):
   1. Cable identification numbers.
   2. Cable design makeup.
   3. Cable lengths between splice points and terminations.
   4. Exact routing of cable.
   5. Strand count, mode of installed fiber, loss per splice in dB, and total amount of optical fibers installed.
   6. Bonding and grounding.
   7. Location and description of all associated structures and obstructions.
   8. Cable entrance locations and penetration details.
   9. Terminal information, outlet numbering, and pair count information at each distribution frame.
   10. Schematic drawings of riser.
   11. Routing of cable and termination information.
   12. Cable pair counts per connector block.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least 3 years experience manufacturing products of the type specified.

B. Installer Qualifications:
   1. The telecommunications installation contractor shall be licensed in the State of Georgia as a Low Voltage Licensed Telecommunications Contractor (LVLTC).
   2. The Contractor shall provide an on-site, full-time Project Manager who will act as a single point of contact for all activities regarding this project.
   3. The LVLTC Project Manager shall make on-site decisions regarding the scope of the work and any changes required by the work.
   4. The Project Manager shall be on the job any time work is being performed or workers are present. The PM shall get written approval prior to committing.
   5. The Project Manager shall be totally responsible for all aspects of the work.
   6. The selected LVLTC shall be fully capable and experienced in the telecommunications distribution system to be installed.
   7. The LVLTC shall have a minimum of five (5) years of experience installing Structured Cabling Systems and be a certified installer of the approved cable/component system solution.
   8. The LVLTC shall have a Registered Communications Distribution Designer (RCDD) on staff that will be ultimately responsible for the project. The credentials (current BICSI certification stamp) of the responsible RCDD shall be attached to the LVLTC's response for evaluation by the State.
   9. A BICSI Certified installer shall be employed by the LVLTC and be on site as the installation manager.
   10. The LVLTC shall provide a minimum of three (3) projects where similar work, both in scope and design, have been completed by the LVLTC within the last two (2) years.

C. Coordinate with the Georgia State Finance and Investment Commission (GSFIC) for all telecommunications service entrances, whether campus or utility owned. GSFIC will perform three inspections during the installation. These inspections will be arranged through the Architect.

D. The GSFIC telecom contact is Mr. Tracy Bracknell. His phone number is 404-463-5673.

1.6 WARRANTY

A. The LVLTC shall furnish a warranty of products, applications and workmanship for fifteen (15) years from the date of acceptance by the State. All other products and workmanship shall carry warranties equal to or greater than the warranty from the date of acceptance by the State.

B. Materials and workmanship shall be fully guaranteed by the LVLTC for fifteen (15) years from the date of acceptance by the State. Defects which may occur, as the result of faulty materials or workmanship, within fifteen (15) years after installation and acceptance by the Owner shall be corrected by the LVLTC at no additional cost to the Owner.

C. The period of the LVLTC's warranty (ies) for any items herein are not exclusive remedies, and the Owner has recourse to any warranties of additional scope given by LVLTC to the Owner and all other remedies available at law or in equity.

D. The LVLTC shall pass along to the Owner any additional warranties offered by the manufacturers, at no additional costs to the Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Cabling: Superior Essex, General Cable, CommScope, Beldon, Hitachi, Draka, Mohawk.

B. Connectivity: Panduit, Hubbell, Siemon, Ortronics, Leviton, Molex, CommScope.

C. Racks: X-Mark, Chatsworth, Homaco, Great Lakes.

D. The system used shall be a certified systems solution comprised of the manufacturers listed above. Manufacturers offering their system solution using their cable and components shall be acceptable.

2.2 SYSTEM DESIGN

A. Provide a complete permanent system of cabling and pathways for telecommunications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
   1. Comply with TIA/EIA-568 and TIA/EIA-569, latest editions.
   2. Provide fixed cables and pathways that comply with NFPA 70 and ANSI/J-STD-607 and are UL listed or third party independent testing laboratory certified.
   3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.
   4. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.
   5. Comply with the latest adopted version of the GTDM.

B. Telecommunications cabling, jacks, patch panels, punch down blocks and other equipment shall be certified for Category 6 operation.

C. All UTP copper cables shall be terminated in rack mounted patch panels. There is no distinction between voice and data cables in a structured cabling system.

D. Products including, but not limited to, cabling, jacks, patch panels, and cabinets shall be consistent throughout the project. All equipment shall have been tested for compatibility as part of a structured cabling system.

E. Active equipment (handsets, hubs, switches, media converters, etc.) is not included in this contract unless otherwise noted.

F. Main Equipment Room (MER): Centrally located support structure for terminating backbone cables, functioning as point of presence to external service provider.
   1. Locate main distribution frame as indicated on the drawings.
   2. Capacity: As required to terminate all cables required by design criteria plus minimum 25 percent spare space.

G. Telecommunications Rooms (TRs): Support structures for terminating horizontal cables that extend to telecommunications outlets.
   1. Locate telecommunications rooms as indicated on the drawings.

H. Backbone Cabling: Cabling, pathways, and terminal hardware connecting telecommunications rooms (TRs) with the main equipment room (MER), wired in star topology with the MER at center hub of star.

I. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.3 PATHWAYS

A. Conduit: Refer to Section 26 0534 for general conduit specifications; provide pull cords in all conduit.
   1. Conduit for horizontal cable distribution shall be minimum 1" trade size.
   2. Provide insulated bushings at each end of all conduits.
   3. All riser and entrance conduits shall be minimum 4" in diameter.
   4. All conduits to receive fiber optic cable shall be provided with three 1-1/4" innerducts.

B. Cable Trays: As specified in Section 26 0536.

C. Sleeves: Minimum 4" threaded galvanized rigid steel conduit with plastic insulating bushing on each end.

D. Ladder Rack:
1. Shall be tubular side bar type nominally 3/8" thick by 1-1/2" high (minimum) with 1/2" x 1" welded rungs spaced 9" on center.
2. Shall be powder coated and black in color.
3. Shall include connecting and all other support hardware for a complete installation.
4. Shall include equipment rack to runway mounting plates, wall angle support brackets, butt splice swivels, junction splice connections and grounding kits.

E. Vertical Ladder Rack:
1. Provide ladder rack as required for backbone cables passing vertically through TRs and/or ERs.
2. Include connecting hardware and all other support hardware for a complete installation.
3. Provide with grounding lug to allow for bonding connection.
4. Shall be tubular side bar type nominally 3/8" thick by 1-1/2" high (minimum) with 1/2" x 1" welded rungs spaced 9" on center.
5. Shall be powder coated and black in color.

2.4 COPPER CABLE AND TERMINATIONS

A. Copper Backbone Cable:
1. The cable shall be available in 25, 50, 100, 150, 200, 300, 400, 600, 900, and 1200 pair counts. See plans for required strand count.
2. All cable shall be UL Listed for Fire Safety.
3. Provide cable having conductors twisted at minimum rate to two per foot (six per meter); actual length and frequency of twists at manufacturer's option.
4. Shall be gray in color.
5. Shall comply with all relevant parts of and addenda to latest editions of TIA/EIA-568 and ICEA S-90-661, and UL 444.
6. Copper Backbone Cable: All UTP copper backbone cable supporting voice communications requirements shall be standard 24-gauge, paired dual, semi-rigid CMP rated as per NEC, except as described below.
7. Copper Vertical Backbone Cables: Shielded or unshielded 24 AWG CMP rated, multi-pair copper cables shall be used as the vertical backbone riser cables.
8. All cable routed under slab on grade shall be wet location listed for that condition. Cable shall transition to the type described above as soon as practicable upon penetrating the slab. The transition shall NOT be in a plenum.

B. Copper Horizontal Cable: TIA/EIA-568 Category 6 solid conductor unshielded twisted pair (UTP), 24 AWG, 100 ohm; 4 individually twisted pairs; covered with blue jacket and complying with all relevant parts of and addenda to latest edition of TIA/EIA-568 and UL 444.
1. All cable shall be NFPA 70 type CMP plenum-rated, except as described below.
2. All cable routed under slab on grade shall be wet location listed for that condition. Cable shall transition to the type described above as soon as practicable upon penetrating the slab. The transition shall NOT be in a plenum.
3. Testing: Furnish factory reel tests.
4. Cables shall be marked with the manufacturer's name, cable type/catalog number and the latest adopted NEC code compliance.

C. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool.

D. Jacks and Connectors: RJ-45, non-keyed, terminated with 110-style insulation displacement connectors; high impact thermoplastic housing; complying with same standard as specified horizontal cable and UL 1863.

1. Performance: 500 mating cycles.
2. Outlet Jacks: 4-pair, pre-wired to T568B configuration, with color-coded indications for T568B configuration.

2.5 FIBER OPTIC CABLE AND ADAPTORS

A. Single Mode Fiber Optic Backbone Cables:
1. See plans for required strand count.
2. Shall be NFPA 70 type OFNP nonconductive-plenum-rated.
3. Class IVa dispersion – un-shifted single mode optical fibers complying with ANSI/EIA/TIA-492BAAA.
4. The zero dispersion wavelength shall be between 1300 nm and 1324 nm. The ANSI/EIA/TIA-455-168 maximum value of the dispersion slope shall be no greater than 0.093 ps/km-nm2.
5. Dispersion measurements shall be made in accordance with ANSI/EIA/TIA-455-169 or ANSI/EIA/TIA-455-175.
6. The nominal mode field diameter shall be 8.7 um.
7. Maximum attenuation dB/Km @ 1310/1550 nm: 1.0/1.0.
8. The cutoff wavelength shall <1279 nm when measured in accordance with ANSI/EIA/TIA-455-170.
9. Shall be 900 um tight buffer.
10. Shall have 2.0 mm sub-unit diameter.
11. Shall be suitable for indoor installations.
12. Strength members shall be all dielectric.
13. Shall incorporate secondary thermoplastic type buffer over each fiber.
14. Shall have individual fiber tube colors per ANSI/TIA/EIA-606A with an overall orange jacket.
15. Provide stiff central member with cables stranded around center.
16. Provide ripcord for overall jacket.
17. The operating temperature range shall be between -20 to 70 degrees centigrade.
18. Shall be factory certified per reel. The certification shall consist of instrument readings from an Optical OTDR noting dB loss per meter, fiber index of refraction and laser wave length. An OTDR test data sheet shall be provided with photograph of graphical output showing display, cable reflectometer trace and all settings.

B. Multimode Fiber Optic Backbone Cables:
1. See plans for required strand count.
2. Shall be NFPA 70 type OFNP nonconductive-plenum-rated.
3. Shall be graded-index optical fiber with nominal 50/125mm core/cladding diameter.
4. Primary coating diameter of 250um UV cured acrylate buffer material.
5. The fiber shall comply with ANSI/EIA/TIA-492AAAB.
6. Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-46, 53 or 61.
7. Information transmission capacity shall be measured in accordance with ANSI/EIA/TIA-455-51 or 30.
8. The measurements shall be performed at 23 degrees C +/- 5 degrees.
9. Maximum attenuation dB/Km @ 850/1300 nm: 3.25/1.0.
10. Bandwidth 200 MHz-km @ 850nm.
11. Bandwidth 800 MHz-km @ 1300nm.
12. Shall be 900 um tight buffer.
13. Shall be suitable for indoor installations.
14. Strength members shall be all dielectric.
15. Shall incorporate secondary thermoplastic type buffer over each fiber.
16. Shall have individual fiber tube colors per ANSI/TIA/EIA-606A and an overall orange jacket.
17. Provide stiff central member with cables stranded around center.
18. Provide ripcord for overall jacket.

19. The operating temperature range shall be between -20 to 70 degrees centigrade.
20. Shall be factory certified per reel. The certification shall consist of instrument readings from an Optical OTDR noting dB loss per meter, fiber index of refraction and laser wave length. An OTDR test data sheet shall be provided with photograph of graphical output showing display, cable reflectometer trace and all settings.

C. Fiber Optic Adapters and Connectors: Duplex SC, push-on-push-off type, multimode adaptors with zirconia ceramic alignment sleeves; complying with relevant parts and addenda to latest edition of TIA/EIA-568 and with maximum attenuation of 0.3 dB at 1300 nm with less than 0.2 dB change after 500 mating cycles when tested in accordance with TIA-455-21.
1. The 568SC connectors shall meet TIA/EIA-604-3 standards.
2. The total optical attenuation through the cross-connect from any terminated optical fiber to any other terminated fiber shall not exceed 1.0 dB.
3. The connectors shall have a return loss greater than or equal to 20 dB for multimode fiber and greater than or equal to 26 dB for single mode fiber.

2.6 CROSS-CONNECTION EQUIPMENT

A. Patch Panels for Copper Cabling: Sized to fit EIA standard 19 inch wide equipment racks; 0.09 inch thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
1. Jacks: Eight position non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel. No 24 port patch panels allowed.
   a. Shall be modular type.
   b. Shall be available in universal wiring schemes (Use T568B).
   c. Housing shall be fire retardant UL 94VO rated thermoplastic and tin lead solder plated IDC.
   d. Housing shall be fully encased to protect printed circuit board and IDC fields.
   e. Modular jack contacts shall accept a minimum of 2500 plug insertions without degradation of electrical or mechanical performance.
   f. Modular jack contacts shall be constructed of Beryllium copper.
   g. Shall utilize a paired punch down sequence. Cable pairs and sheath shall be maintained up to the IDC.
   h. Shall be compatible with single conductor, industry standard 110 type impact termination tools.
   i. Shall include means to hold terminated wires in place.
   j. Shall have an attached color-coded wiring label.
   k. Shall be UL Verified and listed for TIA/EIA Category 6 electrical performance.
2. Shall accommodate 48 ports for each rack mount space. No high density port configurations allowed.
3. Panel circuit boards shall be fully enclosed front and rear for physical protection.
4. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
5. Labels: Factory installed laminated plastic nameplates above each port (front and back), numbered consecutively; comply with TIA/EIA-606 using encoded identifiers.
6. Panels shall provide wiring identification and color code and maintain a paired punch down sequence that does not require the overlapping of cable pairs.
7. Panels shall be Category 6 compliant.
8. Provide incoming cable strain relief and routing guides on back of panel.

B. Rack Mounted Patch Panels for Fiber Optic Cabling: Sized to fit EIA standard 19 inch wide equipment racks; 0.09 inch thick aluminum.
1. Adaptors: As specified above; maximum of 24 duplex adaptors per standard panel width.
2. Shall be available in 12, 24, 48, 72, and 96 port configurations.
3. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA/EIA-606 using encoded identifiers.

4. Provide incoming cable strain relief and routing guides on back of panel.
5. Provide rear cable management tray at least 8 inches deep with removable cover.
6. Provide dust covers for unused adaptors.
7. Provide for cross-connections or inter-connections.
8. Provide with front access design with hinged bulkhead plate. Front cover shall be removable.
9. Panels shall accommodate stackable splice trays, which manage up to 24 splices per tray.

2.7 ENCLOSURES

A. Backboards: Interior grade plywood without voids, 3/4 inch thick.
   1. Size: 48 inches wide by 96 inches high.
   2. Do not paint over UL label.

B. Equipment Racks and Cabinets: CEA-310 standard 19 inch wide component racks.
   1. Floor Mounted Equipment Racks:
      a. Shall be standard 84" in height.
      b. Shall have a universal junction hole pattern.
      c. Shall have #12-24 panel mounting holes.
      d. Shall be capable of supporting a maximum load of 600 Lbs.
      e. Shall be constructed of aluminum alloy.
      f. Shall be finished with flat black powder coat paint.
      g. Cable management units shall be black metal.
      h. Provide with both vertical and horizontal cable management.
      i. Shall be 4 post configuration.
      j. Shall be provided with grounding lug.
         1) Vertical cable management panels shall have front and rear channels, both with removable covers.
         2) A horizontal manager shall be provided at the top of each rack, with a minimum height of 2 rack units each.
         3) Horizontal cable management panels shall also have front and rear channels.
         4) Provide horizontal managers above and below each patch panel, with a minimum height of 2 rack units each.
         5)

C. Outlet Boxes: For flush mounting in walls; depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.
   1. Size, Unless Otherwise Indicated: 4 inches square by 2-1/8 inches deep. Provide with single gang plaster ring.
   2. Faceplates: Type 302 stainless steel, complying with system design standards and UL 514C.
      a. Shall accept up to six jacks in a single gang configuration.
      b. Jacks to be installed in wet or corrosive environments shall be installed in faceplates designated for that purpose.
   3. Modular Furniture Adapter Plates:
      a. Plates shall be made of high impact UL 94VO rated thermoplastic.
      b. Plates shall be UL listed.
      c. Plates shall snap into the modular furniture opening and be retained by integral latching tabs.
   4. Multimedia Housings:
      a. Outlet shall be capable of accommodating up to 12 cables, of any combination of media.
      b. Outlet ports shall be located on the bottom when the outlet is mounted to a vertical surface.
      c. Outlet base shall have mounting holes that will allow it to be mounted to a double-gang wall box.

d. Outlet shall be UL listed.
e. Outlets shall be made of high impact UL 94VO rated thermoplastic.
f. Outlet shall be field configurable for use with multiple cable types and shall have brackets for UTP, BNC, F, and RCA connectors, and small form factor optical fiber connectors.

5. All jacks shall be installed in faceplates.
6. Where different media is shown to terminate in the same location, provide in the same faceplate.

2.8 GROUNDING AND BONDING

A. Telecommunications Grounding Busbar (TGB):
1. Copper Ground Bar (Minimum 1/4"x4"x23")
2. Provide with insulators and a support bracket for isolation.
3. Provide lugs for each bonding conductor and the telecommunications bonding backbone. Terminals shall be solderless compression type, copper long barrel NEMA two bolt.

B. Ground Lugs:
1. Hardware (bolts), bonding connectors and clamps shall be silicone bronze.
2. The copper alloy lug shall be sized for connecting to the Telecommunications Main Grounding Busbar (TMGB) with the Bonding Conductor (BC) and the Telecommunications Bonding Backbone (TBB).

C. Rack Mounted Equipment Ground Bar:
1. Provide a 3/16"x3/4"x18-5/16" bar for attachment to the 19" mounting rails of equipment racks and cabinets.
2. Provide #6-32 silicon bronze screws, ground lugs and other mounting hardware to serve as a splice plate for attachment to multiple racks (if applicable).

2.9 ADMINISTRATION AND LABELING

A. Backbone Conduit: Minimum three inch square surface area tag, mechanically stamped. Acceptable tagging materials are copper, brass or 1/16 inch plastic.

B. Backbone Cables: Self adhesive, self laminating, mechanically printed with a clear protective laminating over-wrap or mechanically printed heat shrink tubing.

C. Horizontal Cables: Self adhesive, self laminating, mechanically printed with a clear protective laminating over-wrap or mechanically printed heat shrink tubing.

D. Cable Trays: Minimum three inch square surface area tag, mechanically stamped. Acceptable tagging materials are copper, brass or 1/16 inch plastic.

E. Equipment Bonding Conductor: Self adhesive, self laminating, mechanically printed with a clear protective laminating over-wrap or mechanically printed heat shrink tubing.

F. Entrance Conduits: Minimum three inch square surface area tag, mechanically stamped. Acceptable tagging materials are copper, brass or 1/16 inch plastic.

G. Telecommunications Grounding Busbar (TGB): Minimum three inch square surface area tag, mechanically stamped. Acceptable tagging materials are copper, brass or 1/16 inch plastic.

H. Equipment Racks and Cabinets: Nameplates shall be white with black core laminated phenolic nameplates with 3/8 inch lettering etched through the outer covering.

I. UTP Patch Panels: Nameplates shall be white with black core laminated phenolic nameplates with 3/8 inch lettering etched through the outer covering.

J. Pull Boxes: Provide 3/4" black stenciled letters on a painted orange rectangular background.

K. Telecommunications Main Grounding Busbar (TMGB): Minimum three inch square surface area tag, mechanically stamped. Acceptable tagging materials are copper, brass or 1/16 inch plastic.

L. Work Area Outlets: White 3/8" self adhesive Mylar tape with 1/4" black, mechanically produced lettering.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA/EIA-568, TIA/EIA-569, ANSI/J-STD-607, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B. The Licensed Low Voltage Telecommunications Contractor (LVLTC) shall install work in accordance with the BICSI Cabling Installation Manual and the latest GTDM.

3.2 BACKBOARDS

A. Install backboards 6" above finished floor to 8'-6" above finished floor.

B. Attach plywood to the wall with 1/4 inch toggle bolts.

C. Coat frame and backboard with two coats of white enamel paint with fire retardant additive.

D. Provide on all walls of Telecommunications Rooms (TRs) and Main Equipment Room (MER).

E. Install distribution rings for the cross-connect fields above all wall mounted blocks. Provide two rings per vertical row of blocks. Mount rings with two hex head screws per ring.

3.3 PATHWAYS

A. Install with the following minimum clearances:
1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
2. 12 inches from power conduits and cables and panelboards.
3. 5 inches from fluorescent and high frequency lighting fixtures.
4. 6 inches from flues, hot water pipes, and steam pipes.

B. Conduit:
1. Do not install more than 2 (two) 90 degree bends in a single horizontal cable run.
2. Runs exceeding 100 feet or 180 degrees total bends shall be broken with suitable sized pull boxes. Pull boxes shall not be located at bends.
3. Factory made large radius sweeps shall be used for 1" trade size and larger.
4. Conduit for horizontal cables shall extend to within 1 inch of top edge of cable tray.
5. Conduit runs to work areas shall serve no more than one Work Area Outlet (WAO).
6. Leave pull cords in place where cables are not initially installed.
7. Conceal conduit under floor slabs and within finished walls, ceilings, and floors except where specifically indicated to be exposed.
   a. Conduit may remain exposed to view in mechanical rooms, electrical rooms, and telecommunications rooms.
   b. Treat conduit in crawl spaces and under floor slabs as if exposed to view.
   c. Where exposed to view, install parallel with or at right angles to ceilings, walls, and structural members.
   d. Under floor slabs, locate conduit at 12 inches, minimum, below vapor retarder; seal penetrations of vapor retarder around conduit.
8. Plug the ends of each roughed-in conduit with an approved cap or disc prior to installation of cables to prevent the entrance of foreign materials and moisture during construction. All conduit shall be clean and dry prior to the installation of telecommunications cabling.

9. Wherever a cluster of four or more exposed conduits rise out of the floor, provide a neatly formed 4" high concrete housekeeping pad with chamfered edges around the cluster of conduits.
10. Install junction and pull boxes in readily accessible locations.
11. Conduits for horizontal cable distribution shall be marked with the space number at all junction boxes and at cable tray and/or backboards.

C. Sleeves:
1. For horizontal cable distribution, provide 4-inch conduit sleeves from the MER and each TR into the adjacent corridor above the room entrance door and to any other adjacent high cable count entry point.
2. Provide a minimum four 4" sleeves at each location described above.
3. Attach cored sleeves on each side of the floor/wall using 1.25" support struts and the appropriate conduit clamps to support the sleeves.
4. Cored sleeves shall extend a minimum of 3-inches AFF and 3-inches below the poured concrete structure.
5. Cored holes shall be sealed as a barrier to prevent smoke and water infiltration between the cored hole and the conduit.
6. Place vertical ladder rack on the wall below or above all sleeves from the floor to the ceiling above.

D. Ladder Rack:
1. Provide in all TRs and MER to support cables not on racks.
2. Shall be installed on all walls around the perimeter of TRs and MER.
3. Shall be mounted to the plywood backboard at 7'-0" AFF and attached to the top of all equipment racks in the space.
4. Support at three foot intervals from either the ceiling, walls, floor, or rack/cabinet.
5. Cable radius drops (waterfalls) shall be attached to the ladder rack stringers or rungs to facilitate cable entering and exiting the runway while protecting the physical properties of the cable.
6. Cables shall be secured to the runway using reusable cable ties to arrange cable in logical bundles.

E. Vertical Ladder Rack:
1. Install on plywood backboard and/or wall above/below all sleeves from the floor to ceiling above.
2. Stand-offs shall be installed as necessary to support the required ladder rack.
3. The anchoring system provided shall be suitable for the type of wall and the weight to be supported by the ladder rack.

F. Grounding and Bonding: Perform in accordance with ANSI/J-STD-607 and NFPA 70.

3.4 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:
1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair (horizontal) use bend radius of not less than 4 times cable diameter.
2. Do not over-cinch or crush cables.
3. Do not exceed manufacturer's recommended cable pull tension.
4. Cables shall not be bound tightly by plastic straps in a manner that distorts cables or jackets. Use VELCRO ties only - no cable ties allowed.
5. Install in accordance with the BICSI Installation Manual.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
1. At Distribution Frames: 180 inches.

2. At Outlets - Copper: 12 inches.
3. At Outlets - Optical Fiber: 39 inches.

C. Copper Backbone Cabling:
1. Cable bend radius shall be maintained to at least 10 times the diameter of the cable.
2. Cable feeder guides shall be used between the cable reel and the conduit.
3. Cable shall be inspected for sheath defects as it is spooled off of the reel. Pulling operation shall be stopped if a defect or any other irregularity is found. Spool cable off from the top of the reel.
4. Use a line tension meter during cable pull to provide accurate measurement of the force exerted on cable. The meter shall have controls to disengage the cable puller if an overload condition occurs.
5. Ground and bond all cable shields per the NEC and TIA/EIA-607.
6. All installed pairs shall be terminated on both ends.

D. Copper Horizontal Cabling:
1. Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.
2. Jacks shall be installed such that cables terminated to the jacks maintain a minimum bend radius of at least 4 times the cable diameter.
3. Cables shall be terminated on jacks such that there is no tension on the conductors in the termination contacts.
4. Provide one cable per jack. No sharing of pairs is allowed.
5. All horizontal UTP cables shall be terminated in patch panels.
6. All horizontal UTP cables concealed in walls or soffits shall be installed in metal conduits.
7. All horizontal UTP cables shall be installed in wire management systems consisting of conduit and/or cable tray continuous from the work area outlet to the TR or MER.
8. Maximum installed horizontal UTP cable length shall not exceed 250 feet.
9. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
10. Copper Cabling Not in Conduit: Use only type CMP plenum-rated cable as specified.
11. Maintain the following clearances from EMI sources:
    a. Power - 12 inches
    b. Fluorescent Lights - 12 inches
    c. Transformers - 36 inches

E. Fiber Optic Backbone Cabling:
1. Prepare for pulling by cutting outer jacket for 10 inches from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.
2. Support vertical cable at intervals as recommended by manufacturer.
3. No fiber optic cable splices are allowed. All fiber strands shall be terminated using connectors specified herein.
4. All fiber optic cables shall be installed in plenum rated innerduct. All innerducts shall be in metal conduits.
5. A pulling lubricant which is compatible with the low density sheath may be used to minimize friction of the optical fiber cable within the innerduct walls.
6. If mechanical or electrical winching devices are used to pull the cable, the cable tension shall be monitored with a commercial dynamometer or load-cell to ensure that the manufacturer's pulling specifications are not exceeded.
7. Use kellum type pulling grips and swivel designed for fiber optic cable pulling.
8. Pulling wheels shall be used when pulling around sharp corners in conduits.
9. The cable jacket shall not be cut or damaged in any way that would expose fiber strands inside.
10. Vertical runs shall be pulled from the top down. Tension shall be relieved for cables which are to continue to the next floor by looping the cable (two feet diameter) on each floor on the backboards with cable ties.
11. Install buffered tubing (from fan-out kit) over the fiber, secure the buffered tubing to the splice tray, run the fan-out tubing up into the fiber enclosure, and install the connectors.

12. Provide maximum length of excess fan-out cable for termination.
13. Neatly tie all cables in loose bundles as they enter the fiber optic patch panel.
14. Install fiber cables paired 1-2, 3-4, 5-6 top down in fiber optic patch panels.
15. Where fiber optic cables pass vertically through slots and sleeves, secure the cable every 18" to the vertical ladder rack.
16. Fiber optic cables shall be labeled per TIA/EIA-606A standards.
17. Connectors shall be installed according to manufacturer's instructions and properly mounted in plates, frames, housings or other appropriate mounting device.
18. Fibers shall be terminated such that there is no tension on the conductors in the termination contacts.
19. Install blank adapter panels in all positions not used in fiber optic patch panels.

F. Floor-Mounted Racks and Enclosures: Permanently anchor to floor in accordance with manufacturer's recommendations.
1. Racks shall be assembled such that mounting rails are perpendicular to the base.
2. Shall be secured to the ladder rack as per the ladder rack manufacturer's recommendations.
3. Mount with a minimum of 36" clear access behind and in front of each rack or enclosure.

G. Faceplates and Adapter Plates:
1. Sufficient cable slack shall be stored behind the faceplate in such a way that allows the manufacturer's specified minimum bend radius of the cables to be maintained.
2. Shall be securely mounted to the mounting bracket.

3.5 GROUNDING AND BONDING

A. Perform in accordance with TIA J-STD-607 and NFPA 70.

B. Install a grounding busbar in each telecommunications Equipment Room and Telecommunications Room.

C. Provide a minimum #6 AWG copper, insulated ground wire from the TGB to the main building grounding electrode system.

D. All metallic equipment racks, conduits, cable trays, ladder racks, etc. shall be bonded to the grounding busbar using minimum #6 AWG copper.

E. Bond the shield of shielded cable to the ground bar in communications rooms and spaces, per applicable code and manufacturers recommended practices.

3.6 ADMINISTRATION AND LABELING

A. All labeling shall be per TIA/EIA-606A standards.

B. Hand written labels are not acceptable.

C. Backbone Conduit: Permanently secure the tag within 6 inches from both ends of the conduit and at all pull boxes.

D. Backbone Cables:
1. Permanently secure the label within 6 inches from both ends of the cable and at all pull boxes.
2. Label shall indicate origination and destination TR or MER identification, sheath ID and strand or pair range.

E. Horizontal Cables:
1. Permanently secure the label within 6 inches from both ends of the cable and at all pull boxes.
2. Label shall indicate TR (or MER), patch panel and port to which the horizontal cable is terminated.

F. Cable Trays: Permanently secure the labels on both sides of the cable tray at 10 foot intervals and at both ends of the cable tray.

G. Equipment Bonding Conductor: Permanently secure the tag within 6 inches from both ends of the equipment bonding conductor.

H. Service Entrance Conduits: Permanently secure the tag within 6 inches from both ends of the entrance conduit and at all access points.

I. Telecommunications Grounding Busbar (TGB): Permanently secure the label within 6 inches of the busbar.

J. Equipment Racks and Cabinets: Permanently secure the labels to the top center portion of the front of the rack/cabinet.

K. Patch Panels: Fiber and copper patch panels shall come labeled from the factory with port number designations.

L. Pull Boxes: Permanently mark all pull boxes on the cover and on at least one side.

M. Telecommunications Main Grounding Busbar (TMGB): Permanently secure the label to the wall or backboard within 6 inches of the TMGB.

N. Work Area Outlets (WAO):
1. Copper UTP cables terminated in a WAO shall be labeled to indicate the following: TR or MER designation, patch panel, and port number to which that cable is terminated.
2. Fiber optic cables terminated in a WAO shall be labeled to indicate the following: the origination and destination TRs or MER, and the individual strand ID.
3. Permanently secure the label to the WAO.

3.7 FIELD QUALITY CONTROL

A. Comply with inspection and testing requirements of specified installation standards.

B. Visual Inspection:
1. Inspect cable jackets for certification markings.
2. Inspect cable terminations for color coded labels of proper type.
3. Inspect outlet plates and patch panels for complete labels.
4. Inspect patch cords for complete labels.

C. Testing - Copper Cabling and Associated Equipment:
1. Test backbone cables after termination but before cross-connection.
2. Test backbone cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between connectors and between conductors and shield, if cable has overall shield.
3. Test operation of shorting bars in connection blocks.
4. Category 3 Backbone: Perform attenuation test.
5. Category 6 Links: Perform tests for wire map, length, DC continuity, attenuation, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, and propagation delay.
6. Utilize a Level IIe tester for Category 6 link compliance. If any part of the installed system results in a "FAIL" indicator on the tester, the problem shall be analyzed and corrected.
7. Testers shall be correctly set to test the type and manufacturer of the horizontal cable used in the link being tested, including the correct NVP.

D. Testing - Fiber Optic Cabling:
1. Backbone: Perform optical fiber end-to-end attenuation test using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures; perform verification acceptance tests and factory reel tests.
2. Multimode Backbone: Perform tests in accordance with TIA/EIA-526-14 Method B.
3. Single Mode Backbone: Perform tests in accordance with TIA-526-7 Method B.

4. Links: Perform optical fiber end-to-end attenuation tests and field reel tests.

E. Complete testing at least two weeks before the scheduled final site observation. Provide test results prior to the final.

F. The manufacturer providing the system warranty shall certify the test results.

G. Replace work considered unacceptable to the Architect as a prerequisite to system acceptance.

H. As part of the submitted test report, provide a sheet stating the acceptable limits for each test, and the Standard Agency and reference where that limit is stated.

I. Identify each test by the WAO identifier.

J. All testing shall be done in accordance with TIA/EIA TSB67.

END OF SECTION

SECTION 27 1300

OUTSIDE PLANT (OSP) CABLING, PATHWAYS, AND COMPONENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Handholes

B. Administration and Labeling

1.2 RELATED SECTIONS

A. Section 27 1005 - Structured Telecommunications Cabling and Enclosures

B. Section 02315 - Excavation

C. Section 02316 - Fill and Backfill

D. Section 02317 - Trenching for Site Utilities

E.

1.3 CONTRACTOR'S REQUIREMENTS

A. The contractor shall provide all equipment shown on the drawings and as specified herein.

B. Provide trenching, shoring, backfill, etc. as required. Provide conduits, innerducts, concrete encasement, handholes, and labeling.

C. Provide service entrance conduits as shown on the drawings. Coordinate exact locations with the GSFIC prior to digging.

D. Provide conduit ductbank as shown on plans for telecommunications entrance. Provide number of entrance conduits shown on the plans. Provide three 1-1/4" innerducts in at least two of the entrance conduits. All conduit shall be buried at a minimum depth of 24" below grade and a traceable warning tape shall be provided above conduit at 8" below finished grade. Maintenance holes or handholes shall be provided at no less than 250-foot intervals of a conduit pathway.

1.4

1.5 SUBMITTALS

A. See Section 27 1005 - Structured Cabling for Voice and Data - Inside-Plant.

1.6 QUALITY ASSURANCE

A. See Section 27 1005 - Structured Cabling for Voice and Data - Inside-Plant.

1.7 WARRANTY

A. See Section 27 1005 - Structured Cabling for Voice and Data - Inside-Plant.

PART 2 PRODUCTS

2.1 CORRUGATED INNERDUCT

A. Shall be constructed of a PVC plastic.

B. Shall be 1-1/4" in diameter.

C. Shall be orange in color.

D. Innerduct located in conduits entering buildings shall be Plenum Rated.

2.2 HANDHOLES

A. Handhole minimum size shall be 36"w x 60"l x 36"d.

B. Covers are to be rated H-20, 25,000 psi.

C. Covers must bolt down.

D. All handholes are to have a minimum of 8-inches of gravel placed in the bottom.

E. All hand holes are to be equipped with (2) 36-inch cable racks on each long wall and four 7.5@ rack hooks for each cable rack.

F. Provide hand holes of additional depths as required to ensure minimum conduit depth is maintained throughout.

G. Cover should be labeled "Telephone", "Communications", "Signal", or "CATV" cast in 2-inch high lettering on the cover.

H. Handholes shall be pre-cast polymer concrete type.

2.3 GROUNDING AND BONDING

A. Underground - As per RUS and ANSI/TIA/EIA 758 requirements.

PART 3 EXECUTION

3.1 ADMINISTRATION AND LABELING

A. Telecommunications Bonding Conductors:
   1. Minimum 3-inch square surface area tag, mechanically stamped, legible and permanently affixed.
   2. Acceptable tagging materials are copper, brass, or 1/16-inch plastic.
   3. Permanently secure the tag within 6 inches from both ends of the Equipment bonding conductor.
   4. Label with the appropriate designations per the ANSI/TIA/EIA 606A standard.

B. Service Entrance Conduits:
   1. Minimum 3-inch square surface area tag, mechanically stamped, legible and permanently affixed.
   2. Acceptable tagging materials are copper, brass, or 1/16-inch plastic.
   3. Permanently secure the tag within 6 inches from both ends of the entrance conduit and at all access points.
   4. Label with the appropriate designations per the ANSI/TIA/EIA 606A standard.

C. Handholes:
   1. Cover should be labeled "Telephone", "Communications", "Signal", or "CATV" cast in 2-inch high lettering on the cover.
   2. Minimum 3-inch square surface area tag, mechanically stamped, legible and permanently affixed.
   3. Acceptable tagging materials are copper, brass, or 1/16-inch plastic.
   4. Label with the appropriate designations per the ANSI/TIA/EIA 606A standard.

3.2 INSTALLATION

A. Conduit and Innerduct:
   1. General: All trenching and duct bank installation shall be the responsibility of the Contractor.
   2. Preparatory Work:
      a. Provide stakes, grade boards, cleats, nails, instruments. Locate and stake each new run for its entire length. Verify elevations.

b. Start excavation at low point. Notify Architect of elevation discrepancies. Protect marks and stations. Before excavating work, coordinate with Owner's Site Representative and other trades.
c. Furnish schedule of operations to Owner and each trade. Provide and maintain temporary bridges, walks and bridges over excavations where underground utility lines, sewers, water lines, etc., cross access roads, walks, and streets. Make necessary arrangement with authorities having jurisdiction.

3. Protection:
   a. Provide bracing, shoring, sheathing and other work for: protection of personnel, the contract work, excavations, trees, shrubs, existing structures, and surrounding properties. Slope sides of excavations to comply with local codes and ordinances.
   b. Provide, erect, and maintain barricades, warning signs, flags, and lights to provide protection for work, workmen, public, and property. Plank walks, pavements, and curbs to be crossed by equipment. Protect adjacent property, existing fences, trees, shrubs, roads, curbs, sidewalks, manholes, hydrants, and other items.
   c. Restore, repair, rebuild or replace any such items damaged or destroyed to condition equal to that existing before such damage occurred.
4. Existing Utilities:
   a. Every attempt should be made to indicate existing utilities as accurately as possible from existing drawings, surveys, and data. Report immediately other utility lines encountered, but not shown on the drawings. Notify the Underground Facilities Protection Organization (UFPO), where same exists, before starting work.. Verify exact location of existing utility lines where work crosses existing utilities and where connections are to be made by test hole before starting work. Notify utility companies, municipalities, owner organizations, and other involved jurisdictions when excavation occurs within vicinity of existing underground service such as sewers, water, electric, gas, telephone, including such services owned by the agency.
   b. If existing service lines, utilities and utility structures which are to remain in service are uncovered or encountered during this excavation, they shall be protected from damage, and securely supported as directed and approved by the involved jurisdiction.. Immediately report damage or injury to utility lines to Owner's Representative and involved jurisdiction. Repair or replace utility lines damaged or injured as directed and approved by the involved jurisdiction. Excavate by hand in proximity to existing underground utility lines; take extreme care when excavating around ductbanks carrying energized cable. Remove plug or cap inactive or abandoned utilities encountered during construction operations. The location of such utilities shall be noted on the as-built drawings.
5. Four-Inch Non-Metallic Conduit (Schedule 40 PVC):
   a. Install spacers in between all conduits being installed.
   b. Cement conduits and fittings in a manner that will allow a water tight seal.
   c. Encase all conduits in concrete.
   d. Conduits shall be sloped (minimum 1% every hundred feet) away from all access points and the building.
   e. Provide a 2-inch high strength foot-marked conduit measuring tape inside each conduit, and secure at each access point.
   f. Seal all conduits using manufactured duct and conduit plugs/seals to prevent moisture, gas and rodents from entering at both ends of the conduit.
   g. All bends shall be sweep bends and there shall be no more than 180-degrees of bends in the conduit between maintenance/hand-holes.

B. Handholes:
   1. Install handhole as shown on the drawings and per the specifications.
   2. Install 6-inches of gravel in the bottom of every handhole.
   3. Install top of the handhole flush with the finished grade.

4. Racking system shall be installed per the manufacturer's instructions.
5. All conduits entering a handhole shall be sealed from the outside of the handhole prior to backfilling.

C. Grounding and Bonding:
1. Underground: Ground and bond per RUS requirements and ANSI/TIA/EIA 758.

END OF SECTION

SECTION 28 3100

FIRE ALARM SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

1.2 RELATED SECTIONS

A. Section 07 8400 - Firestopping: Materials and methods for work to be performed by this installer.

B. Section 21 3000 - Fire Pumps: Supervisory devices.

C. Section 21 1300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.

D. Section 23 3300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code 2008 with 2009 Georgia State Amendments.

B. NFPA 72 - National Fire Alarm Code 2002 Edition, amended by Chapter 120-3-3 of State minimum Fire Safety Standards.

C. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures 2000 Edition amended by Chapter 120-3-3 of the State minimum Fire Safety Standards.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Shop Drawings: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
   4. System zone boundaries and interfaces to fire safety systems.
   5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
   6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
   7. List of all devices on each signaling line circuit, with spare capacity indicated.
   8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
   9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
   10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
   11. Certification by the manufacturer of the control unit that the system design complies with the contract documents.

12. Certification by the Contractor that the system design complies with the contract documents.
13. Do not show existing components to be removed.

C. Evidence of installer qualifications.

D. Evidence of instructor qualifications; training lesson plan outline.

E. Inspection and Test Reports:
1. Submit inspection and test plan prior to closeout demonstration.
2. Submit documentation of satisfactory inspections and tests.
3. Submit NFPA 72 "Inspection and Test Form," filled out.

F. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Complete set of specified design documents, as approved by authority having jurisdiction.
2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
4. List of recommended spare parts, tools, and instruments for testing.
5. Replacement parts list with current prices, and source of supply.
6. Detailed troubleshooting guide and large scale input/output matrix.
7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to the Owner.
8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

G. Project Record Documents: See Section 01 7800 for additional requirements; have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

H. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with his installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
3. Maintenance contract.
4. Report on training results.

1.5 QUALITY ASSURANCE

A. Copies of Shop Drawings: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to the Owner upon completion.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
2. Installer Personnel: At least 2 years of experience installing fire alarm systems.

3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
4. Contract maintenance office located within 50 miles of project site.
5. Certified in Georgia as fire alarm installer.

C. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

D. All components of the Fire Alarm System shall be cross-listed by Underwriter's Laboratories, Inc., for installation in a common system.

E. All control equipment shall be listed under UL category UOJZ as a single control unit.

1.6 EXTRA MATERIALS AND TOOLS

A. Provide spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.

B. In addition to the items in quantities indicated in PART 2, provide the following:
1. All tools, software, and documentation necessary to modify the fire alarm system using the Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
2. CD-ROM copies, 2, of all software not resident in read-only-memory.

1.7 WARRANTY

A. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Material Completion.

B. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Material Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fire Alarm Control Units:
1. Notifier AM 2020 Series with Voice Evacuation.
2. Edwards EST 3 Series
3. Fire Control Instruments
4. Simplex
5. Firelite

B. Initiating Devices, and Notification Appliances:
1. Same manufacturer as control units.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.2 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
1. Provide all components necessary, regardless of whether shown in the contract documents or not.
2. Protected Premises: Entire building shown on drawings.
3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
   a. The Americans With Disabilities Act (ADA).
   b. The requirements of the State Fire Marshall.
   c. Applicable local codes.

d. The contract documents (drawings and specifications).
e. NFPA 101.
f. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.

4. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
5. Program notification zones and voice messages as directed by the Owner.
6. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
7. Master Control Unit (Panel): New, located at as indicated on the drawings.

B. Supervising Stations and Fire Department Connections:
1. Public Fire Department Notification: Provide digital encoder to notify the local Fire Department legally committed to serve the area in which the building is located when an alarm condition is initiated on the fire alarm system. Notification shall be via an approved, U.L. listed monitoring service. The encoder shall be U.L. listed; shall be approved by the local authority having jurisdiction; shall be connected to two outside telephone lines; and shall have a line seizure function. The contractor shall coordinate with the local Fire Department and the authority having jurisdiction concerning who/which monitoring service to be notified in the event of the alarm condition.

C. Circuits: Provide class and style wiring as required for this type of construction and facility.

D. Spare Capacity:
1. Initiating Device Circuits: Minimum 25 percent spare capacity.
2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
3. Master Control Unit: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
4. Each Computer System: Provide uninterruptible power supply (UPS).

F. Operation:
1. The system alarm operation subsequent to the activation of any manual station, automatic detection device, or sprinkler flow switch shall be as follows:
a. All audible alarm indicating devices shall sound an alarm signal until silenced by the alarm silence switch at the control panel.
b. All visible alarm indicating devices shall flash continuously until the Alarm Silence Switch is operated.
c. Subsequent zone alarms shall reactivate the alarm indicating devices.
d. A supervised signal to notify the local fire department shall be activated.
e. Supervised relays interlocked with mechanical controls shall initiate the air handling/ventilation sequence in accordance with NFPA 90 and as specified elsewhere in these specifications and as shown on the plans. Provide relays adjacent starting/control devices in separate enclosure painted red.
2. The alarm shall be displayed on a multi-character LCD display. The characters shall identify the alarm zone and the device type. The system alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged, the LED shall latch on. A subsequent alarm received from another zone shall flash the system alarm LED on the control panel. The LCD display shall show the new alarm information.
3. An alarm tone shall occur within the control panel until the event has been acknowledged.

4. The activation of any system smoke detector shall initiate an Alarm Verification operation whereby the panel will reset the activated detector and wait for a second alarm activation. If, within one (1) minute after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm. If no second alarm occurs within one minute the system shall resume normal operation. The Alarm Verification shall operate only on smoke detector alarms. Other activated initiating devices shall be processed immediately. Smoke detectors with analog sensitivity, adjustable from the control panel may be used in lieu of alarm verification.
5. The system shall have a function that will allow the operator to display all alarms, troubles, and supervisory service conditions including the time of each occurrence.
6. Provisions for a future printer to record all events with corresponding times shall be provided.

G. Supervision:
1. The incoming power to the system shall be supervised so that any power failure shall be audibly and visually indicated at the control panel. A "power on" LED shall be displayed continuously while incoming power is present.
2. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated on the control panel.
3. All devices, detectors, and all wiring within the system shall be supervised.

H. Power Requirements:
1. The control panel shall receive 120 VAC power.
2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of twenty-four (24) hours with five (5) minutes of alarm operation at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic.

I. Peripheral Network:
1. Communication and Addressable Devices: The system must provide communication with initiating devices individually. All of these devices will be individually annunciated at the control panel. Annunciation shall include the following conditions for each point:
   a. Alarm
   b. Trouble
   c. Open
   d. Device missing / failed
2. All addressable devices shall have the capability of being disabled or enabled individually.
3. The system shall have the capability to multidrop up to 400 addressable devices. Systems that require factory reprogramming to add or delete devices are unacceptable.
4. Format: The communication format must be a digital poll/response protocol to allow t-tapping of the circuit wiring. Communication reliability shall be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.
5. Identification of Addressable Devices: Each addressable device must be uniquely identified by an address code. Device identification schemes that do not use unique set addresses but rely on electrical position along the communication channel are unacceptable.
6. Wiring Type, Distances, Survivability and Configurations: Wiring types will be approved by the equipment manufacturer. Existing wiring will be utilized in retrofit applications. The system shall allow a line distance of up to 2,500 feet to the furthest addressable device on a Class B circuit. To minimize wire routing and to facilitate future additions, t-tapping of the communications channel will be utilized.

2.3 EXISTING COMPONENTS

A. Existing Fire Alarm System: Remove existing system completely after new system is fully operational and tested.

B. Clearly label components that are "Not In Service."

C. Remove unused existing components and materials from site and dispose of properly.

2.4 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
   1. Sprinkler water control valves.
   2. Fire pump(s): Trouble signals shall be generated for the following conditions (See NFPA 20, Paragraph 7-4.7, 1999 edition):
      a. Controller has operated into a motor running condition.
      b. Loss of line power on line side of motor starter in any phase.
      c. Phase reversal on line side of motor starter.
      d. Provide 3 (or number required) addressable detector bases and connect to fire pump controller contacts as required.
   3. Elevator shut-down control circuits.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
   1. Sprinkler water flow. See below for interface details.
   2. Kitchen hood suppression activation; also disconnect fuel source from cooking equipment. Provide addressable detector bases as required.
   3. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
   4. Halon system activation. Provide addressable detector for each Halon control panel.
   5. Duct smoke detectors.

C. Elevators:
   1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
   2. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.

D. HVAC:
   1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.
   2. Kitchen Hood Supply Fans: Provide relays as required to stop all supply fans.

E. Doors:
   1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor.
   2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from.
   3. Overhead Coiling Fire Doors: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor.

F. Sprinkler System Interface:
   1. Water flow switches, valve position indicator switches for sprinkler service valves, and zone control valves shall be provided under Division 15 of specifications.
   2. Two separate and distinct signals shall be initiated: one indicating movement of the valve from its normal position and the other indicating restoration of the valve to its normal position.

3. The OFF-NORMAL signal shall be initiated during the first two revolutions of the hand wheel or during one-fifth of the travel distance of the valve control apparatus from its normal position.
4. The OFF-NORMAL signal shall not be restored at any valve position except normal.
5. The main sprinkler control valve(s) and each area/zone valve shall be on a separate fire alarm address.
6. Each flow switch shall be on a separate address. Provide addressable detector bases as previously described.

G. Post Indicator Valve (PIV) and Backflow Preventer (BFP):
1. Connect the PIV and BFP switches to the fire alarm system.
2. Provide waterproof flexible conduit from the switch body, through a WP condulet, to rigid conduit. Route the rigid conduit underground and up into the building, into an accessible ceiling plenum. Conduit size underground shall be minimum 3/4" RGC, coated as specified for underground conduits. Provide conduit inside building as required in other sections of this specification.
3. Provide all required interconnections to building main Fire Alarm Control Panel. Provide addressable interface devices as required for interconnection. Label each addressable device POST INDICATOR VALVE or BACKFLOW PREVENTER as appropriate.

2.5 COMPONENTS

A. General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units, Initiating Devices, and Notification Appliances: Analog, addressable type; listed by Underwriters Laboratories as suitable for the purpose intended.

C. Master Control Unit:
1. Control unit construction shall be modular with solid state, microprocessor based electronics. It shall display the controls and displays essential to operation during a fire alarm condition.
2. A local audible device shall sound during Alarm, Trouble, or Supervisory conditions. This audible device shall sound differently during each condition to distinguish one condition from another without having to view the panel.
3. The following controls shall be visible at the control panel:
   a. Multi-character liquid crystal display.
   b. System alarm LED.
   c. Supervisory service LED.
   d. Trouble LED.
   e. "Power on" LED.
   f. Alarm Acknowledge key/switch.
   g. Supervisory Acknowledge key/switch.
   h. Trouble Acknowledge key/switch.
   i. Alarm Silence key/switch.
   j. System reset key/switch.
4. The following controls and LED's shall be available at the control panel:
   a. Manual evacuation (drill).
   b. Elevator bypass.
   c. Door holder release bypass.
5. Primary Keys, LED's and LCD Display:
   a. The Control Panel shall have a multi-character liquid crystal display.
   b. The Control Panel shall have the capability of handling at least 400 alarm initiation devices.

6. Under normal condition the panel shall display a System is Normal message and the current time and date.
7. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The panel audible signal shall sound for alarm conditions and for trouble and supervisory conditions.
8. The LCD shall display the following information relative to the abnormal condition of a point in the system.
   a. Specific location label.
   b. Type of device (i.e. smoke, pull station, waterflow).
   c. Point status(i.e. alarm, trouble).
9. After all points have been acknowledged, the LEDs shall glow steady and the audible annunciator will be silenced. The total number of alarms, supervisory and trouble conditions shall be displayed along with a prompt to review each list chronologically. The end of the list shall be indicated by an end of list message.
10. When the "Alarm Silence" button is pressed all alarm signals shall cease operation.
11. System Reset:
    a. The SYSTEM RESET button/switch shall be used to return the system to its normal state after an alarm condition has been remedied. The LCD display shall step the user thru the reset process with simple English language messages where multiple steps are required for reset.
    b. Should an alarm condition continue to exist a message will be issued and the system will remain in an abnormal state. System control relays shall not reset. The Alarm LED will be on. The display will indicate the total number of alarms and troubles present in system.
12. History Logging: The system shall be capable of logging and storing a minimum of 50 events in an alarm log and 50 events in a trouble log. These events shall be stored in a battery protected random access memory. Each recorded event shall include the time and date of that event's occurrence.
13. Silent Walktest with History Logging:
    a. The system shall be capable of being tested by one person. While in the testing mode the alarm activation of an initiating device circuit shall be silently logged as an alarm condition in the historical data file. The panel shall automatically reset itself after logging of the alarm.
    b. Should the walktest feature be on for an inappropriate amount of time it shall revert to the normal mode automatically.
14. The fire alarm control unit shall allow for loading and editing operating instructions and sequences.
15. The control unit shall be capable of on site programming to accommodate system expansion and facilitate changes in operation.
16. All software operations shall be stored in a non-volatile programmable memory. Loss of primary and secondary power shall not erase the instructions stored in memory.
17. The control unit shall have the capability of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history.

D. Remote Annunciators: _____.
   1. LCD Annunciators:
      a. Provide LCD annunciator where shown on plans.
      b. Annunciator shall identify device initiating alarm or trouble signal.
      c. Provide alarm and trouble silence switches (and drill switch) in annunciator panel.

E. Initiating Devices:
   1. Manual Pull Stations:

a. Manual pull stations shall be addressable. Pull stations shall contain electronics that communicate the station's status (alarm, normal) to the transponder over two wires which also provide power to the pull station. The address shall be set on the station. The station shall mechanically latch upon operation and remain so until manually reset by opening with a key common to all system locks.
b. The addressable manual station shall be capable of field programming of its "address" location.
c. There shall be no limit to the number of stations, detectors or Zone Adapter modules, which may be activated or "in alarm" simultaneously.

2. Photoelectric Detector Head:
   a. The photoelectric type detector shall be a plug-in unit which mounts to a twist-lock base, and shall be UL approved.
   b. The detectors shall be of the solid state photoelectric type and shall contain no radioactive material. They will use a pulsed infrared LED light source and be sealed against rear air flow entry.
   c. There shall be no limit to the number of detectors which may be activated or "in alarm" simultaneously.
3. Addressable Photoelectric Duct Detector:
   a. The detector shall be a non-polarized 24VDC type which is compatible with the Fire Alarm Panel. Provide and install all detectors referenced in Division 15.
   b. See Photoelectric Detector Head for unit operation. Detector located in air handling unit(s) supplying operating suites within a Health Care Facility shall contain auxiliary contacts (SPST, 3 amps, 125 volts minimum. Refer to Instruments and Controls in Division 15 for additional information.
   c. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel. Detector design shall provide compatibility with other fire alarm detection loop devices (heat detectors, pull stations, etc.)
   d. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housings front cover. Install detectors as required by NFPA 90A.
   e. To minimize false alarms, voltage and RF transient suppression techniques shall be employed as well as an insect screen.
4. Heat Detectors: Thermal detector heads must be UL listed. They will be a combination rate-of-rise and fixed temperature (135 F) type, automatically restorable.
5. Addressable Detector Bases: All addressable smoke detector heads as specified below will be pluggable into their bases. The base will contain electronics that communicate the detector status (normal, alarm, trouble) to the control panel over two wires. The same two wires shall also provide power to the base and detector. Upon removal of the head, a trouble signal will be transmitted to the control panel.

F. Notification Appliances:
1. Audible and/or Visual Units:
   a. Audible horn sound level shall be a minimum 90dBA at 10 feet.
   b. Provide speakers and amplifiers as required for voice evacuation where required. See plans for speaker locations.
   c. Any two visual strobes placed in the same field of view shall flash in synchronization.
   d. Strobes may be located higher than 80" AFF if intensity of strobe is increased to the point that effective intensity is the same as a 75 candela strobe placed at 80" AFF. Wall mounted strobes shall still be located minimum 6 inches below ceiling. Contractor shall submit calculations from fire alarm vendor showing no change in effective intensity for strobes mounted higher than 80" AFF.
   e. Use minimum 75 candela intensity strobes. Strobes shall be xenon type or equivalent.
   f. Flash rate of strobe shall be in the 1 to 2 Hz. range.

g. Maximum pulse duration of strobe shall be 0.2 seconds, with a maximum duty cycle of 40 percent.

G. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.
1. Individual conductors shall be numbered utilizing permanently attached markers at all terminations and junction boxes.
2. Detailed wiring diagrams shall be provided showing color coding and numbering of conductors.

H. Surge Protection: In accordance with IEEE C62.41 B3 combination waveform and NFPA 70; except for optical fiber conductors.
1. Provide surge protection devices at the control panel for all power, signal, and control cables/conductors leaving the control panel.
2. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
3. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
4. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.
5. In addition to above, provide surge protection for any circuit exceeding 1000 feet in length.

I. Locks and Keys: Deliver keys to the Owner.

J. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
2. Provide one for each control unit where operations are to be performed.
3. Obtain approval of the Owner prior to mounting; mount in location acceptable to the Owner.
4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.

B. All wiring shall be installed in strict compliance with all of the provisions of the NEC Article 760.

C. All fire alarm conductors shall be installed in EMT conduit except that rigid metal conduit shall be used as required by Section 26 0534 - Conduit. All conduit shall be factory painted RED.

D. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

E. Obtain the Owner's approval of locations of devices, before installation.

F. Install instruction cards and labels.

G. The manufacturer's authorized representative shall provide onsite supervision of installation and shall provide a Certificate prior to the Final Observation certifying proper operation of the system and all devices.

H. Elevators:
1. Provide relays and contact operations for signaling the elevator controls of initiation of any fire alarm condition and identifying the alarming device.
2. Provide a 1-inch, IMC raceway to the elevator control room.

I. Where NFPA 101 requires acceptance of "equivalent performance" by the authority having jurisdiction, the contractor shall perform all testing and shall make any changes to gain acceptance by the Georgia State Fire Marshal.

3.2 INSPECTION AND TESTING FOR COMPLETION

A. Notify the Owner 7 days prior to beginning completion inspections and tests.

B. Refer to the National Fire Alarm Code, NFPA 72-2002, Sections 10.4.1.1, 10.4.1.2.1.1, and 10.4.1.2.1.4 for Initial Acceptance Testing requirements. Complete and execute the Inspection and Testing form in Figure 10.6.2.3 of this code section. No other forms or affidavits shall be acceptable.

C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

D. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

E. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

F. Provide all tools, software, and supplies required to accomplish inspection and testing.

G. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

H. Demonstrate the operation of all components of the Fire Alarm System at the final inspection. There shall be a representative from the fire alarm contractor on site for the final inspection. The Architect shall witness all tests.

I. The Contractor shall arrange for a worker to remain at the fire alarm control panel for the duration of the test to report status and reset alarms. The Contractor shall arrange for another worker to accompany the Architect to each initiating device and to perform all tests. All items required to test the detectors, such as canned smoke, shall be provided by the Contractor. The Contractor shall also demonstrate that each audible and/or visual strobe is functioning properly.

J. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.3 PERSONNEL INSTRUCTION

A. Provide the following instruction to designated the Owner personnel:
   1. Hands-On Instruction: On-site, using operational system.
   2. Classroom Instruction: the Owner furnished classroom, on-site or at other local facility.
   3. Factory Instruction: At control unit manufacturer's training facility.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
   1. Initial Training: 1 session pre-closeout.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.

D. Detailed Operation: Two-hour sessions for engineering staff; assume NICET level I qualifications or equivalent; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.
   2. Refresher Training: 1 session post-occupancy.

E. Maintenance Technicians: Detailed training for electrical technicians, on programming, maintaining, repairing, and modifying; factory training:
   1. Initial Training: One 3-day session, pre-closeout.
   2. Refresher Training: One 1-day session post-occupancy.

F. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.4 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to the Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

B. Material Completion of the project cannot be achieved until inspection and testing is successful and:
   1. Approved operating and maintenance data has been delivered.
   2. Spare parts, extra materials, and tools have been delivered.
   3. All aspects of operation have been demonstrated to the Owner.
   4. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
   5. Specified pre-closeout instruction is complete.

END OF SECTION

SECTION 311000

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, removing site utilities or abandoning site utilities in place.
7. Temporary erosion- and sedimentation-control measures.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

H. Limits of Work:

1. For use in these Specifications, the Limit of Work is defined as the minimum degree of clearing necessary to construct the improvements. Extend clearing for roadways to the outside shoulders of the road. Clear for utilities no wider than 20 feet. Where graded slopes are necessary to tie to existing grades, limit clearing to the top or 10' beyond toe of slope. Do not extend the Limits of Work onto adjoining property except as indicated by appropriate easement nor into designated non-disturbed buffer and tree save areas.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing. Site conditions are shown based on available information. Visit the site, familiarize yourself with conditions, and verify conditions in the field. Notify the Architect of any discrepancy between plan and field conditions or assume full responsibility for conditions encountered.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Architect.
2. Provide alternate routes around closed or obstructed traffic ways if required by Architect.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Owner.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated by Owner.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Engineering Equipment: Use surveyor's transit and measuring devices properly calibrated to accurately lay out the work.

B. Other Layout Equipment: Provide stakes and batter boards of size and quality commensurate with function. Use wire and non-stretching cord to establish reference lines for site clearing and grading.

C. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31.

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

D. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Clearly mark each tree trunk at 54 inches above the ground.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Architect.
2. Iron Pins and Concrete Monuments: During staking, verify iron pins and concrete monuments within 50' of any clearing or grading operation as property limits and drive #6 Bar 4'-0" long, 1'-6" into the ground at pin points, and paint pin and bar a bright yellow.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Damage to trees located within designated tree save areas is cause for monetary penalty.

B. Throughout construction, properly protect existing trees which are to remain or which overhang the property line.

C. Fence existing trees to remain with Tenax 4' x 1 ½" x 3" orange mesh barrier fence or 4 x 4 posts and double 2 x 4 rails at the tree drip line.

D. Do not cut low hanging branches on trees to be saved, unless approved by the Architect. Use a tree surgeon to cut branches which must be cut to eliminate obstructions. Immediately and properly trim any cuts, or accidental injuries to the bark or trunk, and properly trim and paint with a protective tree wound and sealing compound.

E. Warp up or down between existing grades of root areas and new finished grades surrounding trees to remain. Where fill under 2' occurs, fill with broken stone or washed gravel to full fill depth for a distance of 3' from the trunk in directions, the remaining fill being of light, friable topsoil. Leave any trees in the graded area that are at grade level or where the fill is not over two feet (2'-0") at the option of the Architect.

F. Permit no stripping of topsoil, cutting or filling, burning of trash, dumping of materials, storage of materials or equipment of any kind, or use by personnel for any activities, whether on or off duty, within the spread of branches of trees to remain.

3.4 EXISTING UTILITIES

A. Contractor will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, with permission of Architect.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than seven (7) days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.

E. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods for grubbing within protection zones.
4. Chip removed tree branches and stockpile in areas approved by Architect or dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

C. Disposition: Remove and dispose of off the site, individual trees, shrubs and stumps, along with other rubbish materials cleanly and completely in approved manners so as not to injure trees to remain. Comply with local ordinances and obtain the necessary permits for disposing of trees, stumps, and other debris.

D. Burning: Burning will not be allowed without written approval from local issuing authority and the Architect.

E. Coordination: Complete clearing of the site before topsoil stripping operations are begun. Do not leave loose sticks, roots, branches, or any other debris on the site. Avoid mixture of foreign matter with the topsoil.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION

SECTION 312000

EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Excavation, filling, compacting and grading in the areas shown on the drawings to obtain the required finished ground surface properly prepared to receive pavements, walks, building floor slabs, utilities, and drainage structures.
2. Ditching in soil areas of high moisture content to allow the soil to drain prior to making excavations.
3. Adjustment of moisture content up or down by discing of soils placed in fills if soil tests show drying to be necessary to meet compaction requirements.
4. Spreading topsoils in sufficient quantities to backfill islands, medians, and roadway shoulders and open graded areas.
5. Undercutting unsuitable soil materials and replacing with compacted approved soils.
6. Stockpiling approved soil material in convenient location and in sufficient quantity for use in backfill of walls.
7. Removal from the job of unsuitable, excess materials.
8. Importing material, if required, from offsite.
9. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
10. Excavating and backfilling.
11. Drainage course for concrete slabs-on-grade.
12. Subbase course for concrete walks and pavements.
13. Subbase and base courses for asphalt paving.
14. Subsurface drainage backfill for walls and trenches.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving.

B. Rock Excavation Volume: Volume of rock actually removed, measured in original position, but not to exceed the following mesurements. Unit prices for rock excavation include replacement with approved materials.

1. Measure Rock Excavation volume as follows:

a. Mass Rock:
(1) Quantity of rock excavation will be established from cross sections taken by a representative chosen by the Architect. Prior to any rock excavation, expose the rock to be removed which has not been cross sectioned by the Architect's representative or no payment will be made. Prior to payment for rock excavation, the Architect's representative will prepare final cross sections and verify that the rock has been removed to the proper elevation.

(2) Rock removed before measurement will not receive compensation.
(3) Calculate the quantity of rock using the following limits:
(a) To top of rock;
(b) To 6" below bottom of base course and 1'-0" beyond edge of paving for uncurbed paved areas;
(c) To vertical line one foot behind back of curb;
(d) To 0'- 6" below foundations and footings;
(e) To vertical faces located 1'-0" horizontal distance from each footing or foundation face;
(f) To 6" below bottom of slabs on grade;
(g) To finish grade in cut where rock is removed to finish grade. Where it is not so removed, to the finish rock surface.
(h) To 1'-0" outside forms for concrete work requiring forms.
(i) To neat outside dimensions for concrete work with no forms.

b. Trench Rock:
(1) Measure trench rock by taking level reading at reasonable intervals but not more than ten feet along the exposed trench length before removal of rock.
(2) Rock removed before measurement will not receive compensation.
(3) Calculate the quantity of rock using the following limits:
(a) To top of rock:
(b) To vertical faces 1'-0" beyond the outside of pipe barrel, each side;
(c) To 6" below the pipe barrel for the full trench width;
(d) To vertical faces 1'-0" horizontal distance beyond structures and manholes;
(3) To 6" below bottom of slab for structures.

C. Include in the bid submittal unit costs to purchase and place or perform as specified on the jobsite the following items:

1. surge stone (per ton placed)
2. #57 stone (per ton placed)
3. geotextile fabric (stabilization) (per sq.ft. installed)
4. rock excavation and backfill complete (mass) (per cu.yd.)
5. rock excavation and backfill complete (trench) (per cu.yd.)

1.4 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and di mensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill:

1. Structural Fill is defined as fill supporting retaining wall footings or any structure whatsoever and extending for a distance of ten feet (10') on each side of said structure measured at the finished grade, thereafter tapering away at a 45 degree angle.
2. Paving Area Fill is defined as fill supporting any asphalt, concrete paving, or special paving for parking of cars, or trucks, or concrete walks and extending for a distance of five feet (5') on each side of said area measured at the finished grade, thereafter tapering away at a 45 degree angle.
3. General Area Fill is defined as fill in the general grading area covering banks, lawns, hollows, drainage ditches.

H. "General earth excavation" is defined as follows:

1. Materials regardless of its nature or composition that can be removed by scrapers, leaders, pans, dozers, backhoes, or graders up to and including that material which requires the use of a single tooth ripper mounted on a crawler tractor having a minimum draw bar pull rated not less than 56,000 pounds. Boulders & Partially Weathered Rock as defined in the geotechnical report are included.

I. "Mass rock" as used herein is defined as follows:

1. Material which cannot be excavated except by drilling or blasting;
2. Which is hard enough to ring when struck with a hammer, and the amount is greater than one (1) cubic yard of solid stone in volume; and
3. Which cannot be broken with a heavy single-tooth ripper pulled by the equivalent of a Caterpillar D-8 tractor with a minimum draw bar pull of 56,000 lbs. or by the equivalent of a Caterpillar 977 front end loader.

J. "Trench rock" is defined as follows:

1. Material which occurs in a utility trench;
2. Material which is greater than 2 cubic yards in volume; and
3. Which cannot be excavated by the equivalent of a caterpillar 215 backhoe having a bucket curling force of not less than 25,700 lbs.

K. "Muck" is defined as highly organic or plastic material which cannot support fill, footings, slabs, and pavements and requires removal by power shovels or draglines. Excessively wet or dry materials are not considered unsuitable.

L. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

M. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

N. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

O. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Warning tapes.

B. Samples for Verification: For the following, in sizes indicated below:

1. Geotextile: 12 by 12 inches.
2. Warning Tape: 12 inches long; of each color.
3. Fifty pound sample of each class fill material encountered as directed by the Geotechnical Engineer using care that samples are representative.
4. Fifty pound sample of proposed offsite source fill material.

C. Qualification Data: For qualified testing agency.

D. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698.

E. Blasting plan approved by owner and design professional.

F. Seismic survey report from seismic survey agency.

G. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

H. Submit certification by a Geotechnical Engineer that materials imported to the site contain no hazardous substances.

1.6 QUALITY ASSURANCE

A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:

1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

B. Seismic Survey Agency: An independent testing agency, experienced in seismic surveys and blasting procedures to perform the following services:

1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

D. Preexcavation Conference: Conduct conference at Project site.

E. Soils Report:

1. Obtain a copy of available reports and become familiar with their contents. The Architect makes no assurances as to the contents of the reports. Any claims based on the contents of the reports are disallowed.

F. Adjacent to buildings and in parking lots and roads, grade to within five hundredths (5/100) of a foot of the elevations and contours shown on the Drawings. In open areas, grade to within one-tenth of a foot of those shown on the Drawings. Hand dress grades under buildings, slabs, walks, and steps to obtain the required elevation as shown on the Drawings.

G. Perform no unauthorized or unnecessary grading. This consists of removal of materials beyond the plan limits of grading and removal of materials beyond indicated subgrade elevation or dimensions without specific direction of the Architect's representative. Provide necessary remedial work at no cost to the Architect.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Architect.
2. Provide alternate routes around closed or obstructed traffic ways if required by Architect.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Owner.

C. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures and plant protection measures are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.

5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

1.8 MODULAR RETAINING WALLS

A. Design, construct, guarantee, and warrant modular unit retaining walls under the complete and total responsibility of a single entity.

B. Submit to the Architect with the BID a complete design for the walls, including plan view, sections, and elevations, sealed by a registered Structural Engineer licensed to practice in the project jurisdiction. Submit stamped calculations supporting the design, based on the Soils Report information available. Where additional soils information is needed in order to provide a complete submittal, make whatever tests necessary to acquire adequate information to design the walls.

C. Where walls are installed in cut slopes give particular attention to adequate drainage systems designed to relieve hydrostatic pressure accumulation behind the walls.

D. Submit color and unit type for Architect approval.

E. Warrant the walls and indemnify the Architect against liability related to the design, installation and performance of the walls.

F. Manufacturer:

1. Acceptable modular unit manufacturers include the following:
   a. Amastone Company
   b. Keystone Retaining Wall Systems
   c. Reinforced Earth Company

G. Retain the services of a Geotechnical Engineer and submit certified documentation that the soils encountered are consistent with soil values used in the wall design. Meet manufacturer's requirements for soils testing.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient suitable soil materials are not available from excavations.

B. Suitable Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups approved by the Geotechnical Engineering testing agency; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, organics, and other deleterious matter.

1. Use soils for structural backfill having a minimum dry density of 97 pounds per cubic foot unless otherwise approved by the Geotechnical Engineer.

C. Unsuitable Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 3 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size #57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size #67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

J. Sand: ASTM C 33; fine aggregate.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf ; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf ; ASTM D 4632.
4. Tear Strength: 56 lbf ; ASTM D 4533.
5. Puncture Strength: 56 lbf ; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf ; ASTM D 4632.

3. Sewn Seam Strength: 222 lbf ; ASTM D 4632.
4. Tear Strength: 90 lbf ; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:

1. Portland Cement: ASTM C 150, Type I, Type II, or Type III.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94.
6. Air-Entraining Admixture: ASTM C 260.

B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: 30 lb/cu. ft. minimum at point of placement, when tested according to ASTM C 138.
2. Compressive Strength: 80 psi, when tested according to ASTM C 495.

C. Produce conventional-weight, controlled low-strength material with 80-psi compressive strength when tested according to ASTM C 495.

2.4 MODULAR UNIT RETAINING WALLS

A. Use units of standard quality, free of chips and cracks, and consistent in color and tone chosen by Architect.

B. Remove defective units from the site.

2.5 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

D. Protection of Existing Trees Remaining:

1. Protect tops, trunks, and roots of trees to remain; box, fence or otherwise protect trees which are subject to site work or construction damage. See the Section SITE CLEARING for tree protection and removal of any interfering branches. Immediately and properly trim and paint with a protective tree wound and sealing compound any cuts, or accidental injury to the bark or trunk. Remove protection only when danger from operations no longer exists.

E. Protection of Adjacent Property:

1. For the duration of the construction and until release, protect adjoining property from any excessive drainage and debris. Do not enter upon adjoining property without the permission of the property owner.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Obtain written permission from owner before bringing explosives to Project site or using explosives on Project site.

1. Perform blasting without damaging adjacent structures, property, or site improvements.
2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

3.4 PROCEDURES

A. After clearing and disposal is complete, strip from the top of the existing ground topsoil in all areas to be graded. Stockpile in approved locations where it will not interfere with building or utility operations. Use topsoils free from subsoil, debris and stones larger than 2" in diameter. Locate stockpiles as designated by the Architect. At the completion of the work, distribute topsoil over the grounds to form a minimum cover of 4 inches loose measure on graded areas to receive vegetation and other areas indicated by the Architect. Scarify subgrade prior to

spreading topsoil. Form berms as directed to dispose of excess topsoil and haul off topsoil remaining. Import topsoil to meet the minimum coverage if onsite topsoil is insufficient.

B. Perform exterior grading in accordance with the drawings to ease contours sloping away from the building from sides. In these cases, provide grades of sufficient pitch to drain water from the area.

C. Graded Areas: Repair and reestablish grades to the required elevations and slopes if any settlement or washing occurs prior to the acceptance of the work. Fill to required subgrade levels any areas where settlement occurs.

D. Temporary Grading and Drainage: Provide effective drainage for the entire site.

E. Excavating: Make no footing excavations to the full depth indicated when freezing temperatures or rain is expected. When full depths are reached, protect bottoms from frost or rain if placing of concrete is delayed.

1. Excavate material of every description and whatever substance encountered, to dimensions and levels shown on the Drawings. Excavate work to be clean-cut and true with bottoms level and sound.
2. Lab Testing: The Geotechnical Engineer will make necessary tests for required soil bearing values, and soil compaction.
3. Existing Site Conditions: Excavate any existing depressions or trenches that are encountered and are entirely within the new building walls, or within 5 feet of walls, to solid subgrade and fill with compacted gravel or concrete to underside of new foundation or floor slab.
4. Unsuitable Bearing Material: Place the bottom of trenches, foundations and footings and base for paving on compacted suitable material. Remove loose materials, surface vegetation, debris and existing fill before any fill is placed. Proof roll the subgrade in the presence of the Geotechnical Engineer. Fill operations can then take place. Do not place footings until the Geotechnical Engineer and the Architect have examined and approved the soil upon which they will rest. If the bearing capacity at the levels indicated be found by the Testing Laboratory to be insufficient, the Architect may order the excavations carried to proper bearing. Inspect and approve excavations for footings carried deeper than required by error for proper bearing and then fill only with concrete, same as specified for footings, at no additional cost to the Architect. Provide a minimum of six (6) inches compacted graded aggregate base stone between bottom of footings and any rock encountered. Compact fill in accordance with requirements for backfill.
5. Extend excavation, to the depths and dimensions required by the drawings, including removal of rock.

3.5 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials includes rock, trash, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for conditions encountered.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades to permit installation of permanent construction to dimensions required for rock excavation measurement and payment s a minimum.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and measured. The Contract Sum will be adjusted for rock excavation according to the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock. Measure rock excavation for payment to lines and subgrade elevations indicated to permit installation of permanent construction.

3.6 ROCK EXCAVATION

A. When rock is encountered, clear away earth and notify the Architect. Architect will inspect material and issue written instructions. Do not excavate rock without written instructions.

B. Blast in accordance with local ordinances, and obtain permits where required by law. Complete blasting before any building footing is poured.

C. Remove excavated rock from the site. Bury as allowed by the specifications.

D. Use rock for rip-rap and erosion control as required by the plans. Meet the specifications for rip-rap.

E. Excavate rock to below bottom of building slabs and footing, pavement, and piping to dimensions specified for measurement as a minimum.

3.7 EXCAVATION FOR MUCK

A. When muck is encountered notify Architect immediately. The Architect or Geotechnical Engineer will inspect the material and issue written instructions.

B. Quantity of muck will be established from taking level reading by a representative chosen by the Architect. Take the readings at reasonable intervals to identify the contours of the area.

C. Muck removed before measurement will not receive compensation.

D. Calculate the quantity of muck by making surveys before and after removal. Base payment on the quantity of muck removed as calculated using the surveys.

E. Stockpile muck on site and reuse as allowed by the Geotechnical Engineer. Remove material which is not reused from the site. Provide settling ponds, dikes, piping, and appurtenances to prevent stockpile runoff from discoloring nearby streams.

3.8 EXCAVATION EMBANKMENT AND BRACING

A. Accept full responsibility for excavations. Protect excavation embankments against collapse. Where possible, make embankments over 5'-0" high at a slope not greater than 2:1 unless a steeper slope is recommended by a Registered Geotechnical Engineer.

B. Where it is not possible to provide a safe environment for slopes, temporarily support banks and maintain securely until permanent support has been provided.

C. Provide cross bracing and shoring to prevent collapse, where ditches or trenches are over 5'-0" deep.

D. Provide bracing systems designed and sealed by a Registered Engineer experienced in such designs. Use the design drawings to show the work and sequence in its entirety and submit to the Architect prior to commencing the work.

E. To prevent caving or settlement of earth adjacent to excavations, and for the protection of persons as well as property, provide shoring, bracing, and other similar material to meet the conditions in each particular case encountered. Leave in place until construction has reached a point where backfills behind walls or in ditches have been made and the need for shoring and bracing has been eliminated.

3.9 FOUNDATION TEST BORINGS

A. The Geotechnical Testing Lab will provide labor and material to drill 2" diameter earth auger borings in foundation trenches for footings to a depth of 6'-0" below bearing. Locate boring and specify quantities as directed by the Geotechnical Engineer and do not exceed the equivalent of one boring per 50 linear feet of foundation lines. Use a Registered Geotechnical Engineer to verify the bearing.

3.10 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots.

3.11 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.12 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots.

3.13 EXCAVATION FOR ELEVATOR CYLINDER

A. Drill well hole plumb in elevator pit to accommodate installation of elevator-cylinder assembly. Coordinate with applicable requirements for diameter and tolerances in Division 14.

B. Provide well casing as necessary to retain walls of well hole.

3.14 SUBGRADE INSPECTION

A. Notify design professional when excavations have reached required subgrade.

B. If Geotechnical Testing Agency determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proofrolling

1. Contact the Architect's representative and the Geotechnical Engineer at least 48 hours in advance of proofrolling.
2. Clear and strip as herein specified areas to receive controlled structural and paving area fill. After removal of existing structures and topsoil, and before placement of any structural and paving area fill, proofroll that portion of the footing area and paved areas to re

ceive fill to a distance of ten feet (10') beyond the limits. Accomplish proofrolling with a loaded twenty (20) ton minimum dump truck with two (2) complete coverages in each of two (2) perpendicular directions unless otherwise allowed. Accomplish proofrolling under the observation of the Geotechnical Engineer.

3. Undercut up to 6 inches in depth any areas which 'pump' under the wheels of the loaded truck and replace with clean, compacted fill, at no cost to the Architect. If pumping continues after the 6 inches of undercutting and backfill, the Geotechnical Engineer will notify the Architect immediately and offer his professional recommendations as to the course of further construction. Undercutting below 6" may be classified as additional work.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Geotechnical Testing Agency, without additional compensation.

3.15 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Geotechnical Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by design professional.

3.16 ADDED EXCAVATIONS

A. Should the bearings at the levels indicated be found by the Geotechnical Engineer to be insufficient, the Architect may order the excavations carried to proper bearings. This work may be classified as additional work. Adjust the contract sum as provided for in other divisions.

3.17 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.18 FILLING AND BACKFILL

A. Provide grading required for subgrade, under floor slabs, paved walks, drives, parking areas and against walls. Construct fills as herein specified.

B. Clear and grub vegetation from areas to be filled. Scarify the ground to insure bond between the fill and the original surface. For fill to be placed on hillsides, plow deeply or, where existing ground is steeper than 2:1, bench the existing ground surface before beginning the filling operations.

C. Place fill material in uniform, horizontal layers, not more than 8" thick. Moisten each layer as necessary to insure a proper bond and maximum compaction. Use suitable equipment to mix the material and insure uniform moisture content. Fully and uniformly compact each layer with a sheep's foot roller or vibratory roller of the proper size and weight to achieve specification.

3.19 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.20 BACKFILL AGAINST FOUNDATION WALLS, IN TRENCHES AND EXCAVATIONS, AND OTHER NECESSARY LOCATIONS

A. Do not place backfill against foundation walls until foundation walls are braced and have cured sufficiently to develop the strength necessary to withstand, without damage, the pressures that will result from backfilling and compacting operations. Secure approval of the Geotechnical Engineer before commencing backfilling.

B. Placing Backfill: Place backfill material in uniform, approximately horizontal layers, not exceeding 8" before compacting. Compact each layer with pneumatic tampers or sheepsfoot roller to optimum moisture to produce a minimum of 95% of the standard proctor maximum dry density (ASTM D-698). Coordinate with the Geotechnical Engineer to perform tests of fill density in place for every lift. Submit reports of tests to the Architect.

C. Surplus Materials: Dispose of excess or unsuitable materials.

3.21 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03.

D. Shallow Trenches under Roadways: Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Division 03.

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Place and compact initial backfill of subbase material or satisfactory soil, free of particles larger than 2 inches in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

H. Place and compact final backfill of satisfactory soil to final subgrade elevation.

I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

J. Install warning tape directly above utilities, 18 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.22 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use paving area fill.
3. Under steps and ramps, use structural fill.
4. Under building slabs, use structural fill.
5. Under footings and foundations, use structural fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.23 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 3 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 3 percent and is too wet to compact to specified dry unit weight.

3.24 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent.

2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.25 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

C. Grading:

1. Place fill as specified for backfill except as noted herein. Accomplish compaction by traversing with a sheepsfoot roller or other approved heavy grading machinery. Compact fill to a minimum of 95% of the standard proctor maximum dry density (ASTM specifications D-698) to 12 inches below subgrade for structural fill areas for a minimum distance of ten feet outside of structure perimeter and for locations for future buildings. Compact parking area fill soils to 95% of the soil's standard density to 12 inches below subgrade. Compact general fill areas to 90% of the standard density.
2. Compact the upper 12 inches of fill in structural fill areas and paving areas to 98% standard proctor density.
3. Preparation of sub-grade for slabs: Remove roots and debris subject to termite attack, rot or corrosion and other material not suitable for fill. Fill holes and minor depressions and compact fillings as specified herein including re-compaction of sub-grade. Place sub-grade soils within +/-3% of the soils optimum moisture content per ASTM 698, contain no deleterious material and no rock fragments over 4" (inches) in diameter.

3.26 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Division 33.

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 3-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 3 inches of filter material, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer with a minimum of two passes of a plate-type vibratory compactor.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer with a minimum of two passes of a plate-type vibratory compactor.

2. Place and compact fill over drainage backfill in 6-inch thick compacted layers to final subgrade.

3.27 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Where specified, install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase course and base course to required crown elevations and cross-slope grades.
4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.28 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Where specified, install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.29 MODULAR UNIT RETAINING WALLS

A. Construct walls to clean, straight horizontal and vertical lines in accordance with manufacturer's instructions.

B. Place backfill to meet design specifications.

C. Submit sufficient documentation by the Wall Geotechnical Engineer to show that construction conditions are consistent with design parameters for soils.

D. Mix units to minimize color tone variations in the wall. The Architect may require reconstruction of wall sections where noticeable color variation occurs due to lack of or inappropriate mixing.

3.30 FIELD QUALITY CONTROL

A. Testing Agency: Architect will engage a qualified geotechnical engineering testing agency to perform tests and observations during Earthmoving operations.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Structural Fill and Paving Area Fill: At subgrade and at each two feet of compacted fill and backfill, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each two feet of compacted backfill layer, at least one test for every 50 feet or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each two feet of compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
4. General Area Fill: At each two feet of compacted fill layout for every 10,000 sq.ft. of area.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained, at no cost to the Architect. Pay for all failed tests.

3.31 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.32 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property, unless otherwise directed by the Owner.

B. During the construction and clean-up, do not dump debris on any part of the property or in any unauthorized place. Remove debris, construction material, equipment, logs, stumps, boulders, or any other extraneous material deposited during construction from the site. Remove existing debris or other extraneous material from undisturbed areas. Material that is removed from the site is the property of the Contractor.

END OF SECTION

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 31 2300

EXCAVATION AND FILL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to Work of this section.

1.2 STANDARDS

A. The following Standards are listed in this specification:

ASTM C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C150	Standard Specification for Portland Cement
ASTM D448	Standard Classification for Sizes of Aggregates for Road and Bridge Construction
ASTM D698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft)
ASTM D1557	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))
ASTM D1621	Standard Test Method for Compressive Properties of Rigid Cellular Plastics
ASTM D2487	Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D4253	Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D4254	Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density

1.3 DESCRIPTION OF WORK

A. Earthwork: The extent of earthwork is indicated on the drawings. The work, in general, includes the following items:

1. Excavation and backfill for building structure and foundation.

2. Preparation of subgrade for building slabs, and walks.

3. Excavation, backfill and related materials for perimeter and underfloor foundation drainage system.

4. Excavation and backfill in conjunction with underground mechanical and electrical utilities under slabs on grade, and mechanical and electrical appurtenances that are buried under the building slab.

5. Rough and finish grading adjacent to the building.

6. Furnishing Unit Prices for additional earthwork.

B. Excavation Definition: "Excavation" consists of removal of all material encountered to required subgrade elevations indicated and subsequent disposal of all materials removed.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with all applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Services:

1. Design Professional's Testing Laboratory: The Design Professional will engage a soil testing and inspection service for quality control testing during earthwork operations. Reference Section entitled "Testing Laboratory Services".

2. Contractor's Testing Laboratory: The Contractor shall engage at his own expense a testing laboratory acceptable to the Design Professional to perform quality control testing of all proposed soil materials. Reference Section entitled "Testing Laboratory Services".

C. Depth of Bearing Strata: It is to be understood that site soil conditions are variable across the site. Footing design dimensions and bearing elevations shown are minimums. The design of the footings is based on the assumed strata bearing capacity at the elevation shown on the drawings and as indicated in the General Notes. If the indicated depth of footing excavation is reached without developing the required strata bearing capacity, the Design Professional's Geotechnical Engineer on site will immediately advise the Contractor on the required bearing elevation for each individual footing or mat. Revisions will be paid for in accordance with the Contract condition relative to changes in the Work.

D. Survey Work, Grades, and Elevations:

1. Grades and Elevations: Finished grades indicated by spot elevation and normal contour line elevations denote finished top surface elevations. Report conflicts, errors and inconsistencies in grades and elevations to Design Professional for resolution. Do not proceed with the work in questionable areas until conflicts are resolved by the Design Professional.

2. Survey Work: Lay out work to the lines and levels required before excavation. Record actual measurements of each footing and mat plan centerline location, bottom elevation, deviation from specified tolerances, and all other pertinent data as required.

1.5 SUBMITTALS

A. Laboratory Test Reports: Submit the following reports directly to the Design Professional from the testing services, with copy to Contractor:

1. Test reports on borrow and fill material including optimum moisture-maximum density curve for each type of soil.

2. Verification reports of each footing subgrade.

3. Field density test reports.

4. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

5. All other test reports as required by "Testing Laboratory Services", and other specification sections.

6. Product Data.

1.6 JOB CONDITIONS

A. Site Information: Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Data are made available for convenience of Contractor. Additional test borings and other exploratory operations may be made by the Contractor at no cost to the Design Professional.

B. Removal of Items Remaining from Demolition: Include as part of earthwork the breaking up and removal of all concrete slabs, pavements, footings, foundations, cisterns, septic tanks, abandoned underground utility lines and all other obstructions remaining from previous demolition operations that may have occurred.

C. Existing Utilities:

1. The drawings indicate the locations of known active and inactive above grade and below grade utilities. Locate all existing underground utilities in areas of work before proceeding. Provide adequate support and protection during earthwork operations of utilities that are to remain in place. Demolish and completely remove from the site existing utilities indicated to be removed. Coordinate with utility companies for proper shut-off of services for active lines.

2. If any active utility not indicated in drawings is encountered, notify Design Professional and protect from damage until instructions for proper disposition of the utility are given by the Design Professional. Perform the requested work in compliance specifications of the Design Professional.

3. Repair active utilities scheduled to remain that are damaged by earthwork operations to the satisfaction of the utility owner.

4. If any inactive utility not indicated on the drawings is encountered, remove, plug, or cap as directed by the Design Professional. Obtain any necessary data relative to proposed abandonment of existing utility service from utility owning the utility service.

5. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by Design Professional and then only after acceptable temporary utility services have been provided.

   Provide minimum of 48-hour notice to Design Professional, and receive written notice to proceed before interrupting any utility.

D. Use of Explosives:

1. The use of explosives is not permitted.

E. Protection of Persons and Property:

1. Barricade open excavations occurring as part of this work and post with warning lights. Operate warning lights as recommended by authorities having jurisdiction.

2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

3. Perform excavation within drip-line of large trees to remain by hand, and protect the root system from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of 1" diameter and larger with emulsified asphalt tree paint.

4. Accidental or Careless Damage to Work Intended to Remain in Place: Restore to a condition as good or better than existed before work was commenced as approved by the Design Professional and at no additional cost to the Design Professional.

PART 2 - PRODUCTS

2.1 DEFINITION OF SOIL MATERIALS

A. Satisfactory Soil Materials: Satisfactory soil materials are defined as those complying with ASTM D 2487 soil classification groups GW, GP, GM, SM, SW, and SP. Some CL materials subject to the requirements for "Select Fill" may be acceptable.

B. Unsatisfactory Soil Materials: Unsatisfactory soil materials are defined as those complying with ASTM D 2487 soil classification groups GC, ML, MH, CH, OL, OH, and PT. Groups SC and CL are also unsatisfactory unless conforming to requirements specified below.

C. Fill and Backfill:

1. Definition: "Fill" is soil material that is used to raise existing grades such as under foundation slabs or above footings, or to replace unsuitable material. Backfill" is soil material that is used to fill an excavation, to fill against the structure, or to fill behind foundation walls.

2. Select Fill: "Select fill" material shall be used as noted on the drawings as fill and/or backfill and shall conform to one of the following:

   a. Sandy clay or clayey sand having a plasticity index between 7 and 15 and a liquid limit not exceeding 35. Material shall be free of debris, roots, vegetation, organic matter and all other deleterious substances and free of rock or gravel greater than 2" in any dimension.
   b. Satisfactory Soil Material as defined above free of clay, rock, or gravel larger than 2" in any dimension and free of debris, roots, vegetation, waste and all other deleterious materials.

3. Drainage Fill: "Drainage fill" shall be used as noted on the drawings as fill material that is used around a drainage pipe in a wall drainage system or under a foundation slab as part of an underfloor drainage system and shall conform to the following:

   a. Uniformly graded mixture of natural or crushed gravel, crushed stone, and natural sand, conforming to the coarse aggregate requirements of ASTM C 33, size 67 with 100% passing a 1" sieve and 0% to 5% passing a No. 8 sieve.
   b. Washed evenly graded mixture of crushed stone or crushed or uncrushed gravel, ASTM C33; coarse-aggregate grading Size 56; with 100% passing a 1 1/2" sieve and not more than 5% passing a No. 4 sieve.

4. Drainage Backfill: "Drainage backfill" shall be used as noted on the drawings as backfill material that is used behind a foundation wall as part of a wall drainage system Drainage

backfill must be compatible with any drainage fill material to which it comes in contact as part of the complete wall drainage system. Drainage backfill shall conform to the following:

a. A washed free draining river sand graded so that 100% will pass a 3/8" sieve and less than 3% shall pass a No. 200 sieve.
b. Washed evenly graded mixture of crushed stone or crushed or uncrushed gravel, ASTM D448; coarse-aggregate grading Size 57; with 100% passing a 1 1/2" sieve and not more than 5% passing a No. 8 sieve.

5. Impervious Fill: "Impervious Fill" shall be used as noted on the drawings as backfill material that is used as a cap to seal off surface water from penetrating into backfill below. The material shall be lean clay with a Liquid Limit of between 35 and 50, with a Plasticity Index of between 20 and 30, and capable of compacting to a dense composite.

6. Granular Base under slab-on-grade: "Granular Base" material shall be used as noted on the drawings as fill material between the moisture retarder and the slab and shall be a clean, well-graded, granular mixture of crushed stone, crushed, recycled concrete, or crushed or uncrushed gravel that is trimmable, compactable, and drains well.

   The following materials are acceptable:

   Crushed, recycled concrete with 100% passing the 1 1/2 inch sieve, 45% to 60% passing the 3/8" sieve, 25% to 40% passing the #4 sieve, 20% to 35% passing the #8 sieve, 10% to 30% passing the #100 sieve, and 0% to 5% passing the #200 sieve.

7. Leveling Sub-base under Moisture Retarder: "Leveling Sub-Base" shall be used as noted on the drawings as a thin smoothing layer over the sub-grade and directly below the moisture retarder. The material shall be a clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D448, size 10, with 100 percent passing a No. 4 sieve and 10 to 30 percent passing a No. 100 sieve; meeting deleterious substance limits of ASTM C33 for fine aggregates.

8. Use of On-site Materials: On-site materials may be used for fill and backfill only when approved by the Design Professional's Testing Laboratory.

D. Approval: All soil materials used for the project shall be approved by the Design Professional's Testing Laboratory prior to hauling or placement. Soil materials used for fill and backfill shall be retested and reapproved each time the source or character of the material changes.

E. Filter Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile: made from polyolefins, polyesters, or polyamides: and with the following minimum properties determined according to ASTM D4759 and referenced standard test methods:

   Grab Tensile Strength: 100 lbf: ASTM D4632
   Tear Strength: 40 lbf: ASTM D4533
   Puncture Resistance: 50 lbf; ASTM D4833
   Water Flow Rate; 90 gpm per sq. ft.; ASTM D4491
   Apparent Opening Size; No. 50; ASTM D4751

F. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polylolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

   Grab Tensile Strength: 200 lbf: ASTM D4632
   Tear Strength: 75 lbf: ASTM D4533

Puncture Resistance: 90 lbf; ASTM D4833
Water Flow Rate; 4 gpm per sq. ft.; ASTM D4491
Apparent Opening Size; No. 30; ASTM D4751

G. Geocomposite Drainage System: A manufactured system consisting of a geotextile filter fabric specified above that is fusion bonded to a high-impact plastic cuspated core and with the following minimum properties.

Flow rate, @3600 psf and hydraulic gradient = 1.0, ASTM D4716: 5 gpm/ft. width
Compressive Strength, ASTM D1621: 15,000 psf

Provide one of the following:

"MiraDRAIN MD-2000", TC MiraDRI, Inc., Norcross, GA
"Sheet Drain HS", Greenstreak, St. Louis, MO
"J-DRain 300", JDR Enterprises, Inc., Alpharetta, GA
"Hydraway 100", Solutia, Inc., St. Louis, MO
"Enkadrain 9010", Akzo Nobel Geosynthetics Company, Enka, NC

H. Slotted Collector Pipe: Provide Schedule 80 PVC pipe with 0.10 inch slots comprising a minimum of 8% of the total surface area of the pipe but no more than 10%.

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

A. Remove all existing slabs, pavements, trash, rubbish, debris, trees, roots, stumps, underbrush, grass, shrubs, plants and other vegetation from within the mass excavation limits.

3.2 PREPARATION

A. Survey Work:

1. Set required lines and levels as required to accurately perform the excavation work.

2. Maintain all bench marks and other reference points.

B. Protection of Existing Work:

1. Protect bench marks and existing structures, utilities, roads, sidewalks, paving , curbs and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations. In areas where excavations must be carried to such depths that surcharge from streets, sidewalks, or earth pressure create hazardous conditions, provide sheet piling, shoring and bracing, or combinations thereof, as required to protect excavations. Remove shoring and bracing before backfilling is completed, but not before permanent supporting structure is in place.

2. Protect excavations by laying back sides on a maximum 1:1 slope or by other methods as required to prevent cave-ins and loose dirt from falling into excavations.

3. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil- bearing water runoff or airborne dust to adjacent properties and walkways.

4. Notify Design Professional of any unexpected subsurface conditions. Discontinue work in area until Design Professional provides notification to resume work.

3.3 EXCAVATION

A. Unclassified Excavation: The excavation for this project is unclassified. The Contractor is required to excavate to subgrade elevations specified, regardless of the character of materials or obstructions encountered. No additional costs will be paid by the Owner for any underground obstructions encountered.

B. Unauthorized Excavation:

1. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Design Professional. Unauthorized excavation, as well as remedial work directed by Design Professional, shall be at Contractor's expense.

2. Under footings, foundation bases, or foundation walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill or cement stabilized sand may be used to bring elevation to proper position, when acceptable to Design Professional and approved by the Geotechnical Engineer.

3. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Design Professional.

C. Approval of Subgrade:

1. When excavation has reached required subgrade elevations, notify Design Professional's Geotechnical Engineer who will make an inspection of conditions.

2. Proofroll exposed subgrade below building with appropriate compaction equipment. Conduct proofrolling operations only in the presence of the Design Professional's Geotechnical Engineer. Undercut areas which "pump" or "rut" during operations to firm natural soil, and backfill and compact as specified.

3. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material with cement stabilized sand, lean concrete, or select fill as directed by Design Professional's Geotechnical Engineer.

4. Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in the work.

5. Reconstruct subgrades damaged by freezing temperature, frost, rain, accumulated water, or construction activities as directed by the Design Professional's Geotechnical Engineer.

D. Stability of Excavations:

1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction and in accordance with the requirements noted in the Geotechnical Report. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

2. Maintain sides and slopes of excavations in safe condition until completion of backfilling. Protect slopes from erosion by covering the slope with material such as polyethylene sheet.

E. Shoring and Bracing:

1. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.

2. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

3. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

F. Dewatering:

1. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

2. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

3. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches. Do not discharge drainage water lines into municipal sewers without municipal approval. Prevent water running onto adjacent properties and public thoroughfares. Direct surface drainage away from excavated areas.

G. Material Storage:

1. Where required by schedule or site limitations, stockpile satisfactory soil materials and/or select fill where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

2. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.

3. Dispose of excess soil material and waste materials as herein specified.

H. Excavation for Structures:

1. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10'. Excavations for footings and mats may be neat excavated where possible with sides and top edges free of loose or wet materials. Where neat excavation is not possible, excavate by open cut and allow sufficient distance from the edge of footings and foundations to permit placing and removing concrete formwork, installing services, other construction, and for inspection.

2. In excavating for footings and foundation, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Where

unsatisfactory bearing surfaces are encountered, the area shall be undercut as required and backfilled with cement stabilized sand or lean concrete as directed by the Geotechnical Engineer. Trim bottoms to required lines and grades to leave solid, clean, level and flat base to receive other work.

3. Protect soils exposed at the base of completed foundation excavations against disturbance from construction activities and changes in moisture content. Excavations shall not be left overnight unless it is protected with a minimum 2" thick seal slab of lean concrete. Where the bottom of the excavation will be exposed to movement of crawler type heavy equipment, the contractor may leave about one foot of undisturbed soil above indicated bottom of footing elevations until just prior to final excavation.

I. Excavation and Backfilling for Trenches:

1. Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 6" to 9" clearance on both sides of pipe or conduit.

2. Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to keep the top of pipe or conduit below the frost line.

3. Where rock is encountered, carry excavation 6" below required elevation and backfill with a 6" layer of crushed stone or gravel prior to installation of pipe.

4. For pipes or conduit 5" or less in nominal size and for flat-bottomed multiple-duct conduit units, do not excavate beyond indicated depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.

5. For pipes or conduit 6" or larger in nominal size, tanks and other mechanical/electrical work indicated to receive subbase, excavate to subbase depth indicated, or, if not otherwise indicated, to 6" below bottom of work to be supported.

6. Except as otherwise indicated, excavate for exterior waterbearing piping (water, seam, condensate, drainage) so top of piping is not less than 3'-6" below finished grade.

7. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.

8. Backfill trenches with concrete where trench excavations are close to column or wall footings such that the bottom of the excavation is below the zone of influence of such footings, or which pass under wall footings. The zone of influence of a footing is defined by 45 degree planes extending downward from the bottom edges of the footing. Place concrete to level of bottom of adjacent footing. In other locations, backfill trenches with select fill.

9. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Geotechnical Engineer or other authorized Design Professional's representative. Use care in backfilling to avoid damage or displacement of pipe systems.

10. For piping or conduit less than 2'-6" below surface of roadways, provide 4" thick concrete base slab support. After installation and testing of piping or conduit, provide minimum 4" thick encasement (sides and top) of concrete prior to backfilling or placement of roadway subbase.

J. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F.

3.4 PLACING FILL AND BACKFILL

A. Location: Place satisfactory and approved soil material in layers to required subgrade elevations for each area classification listed below:

1. Excavations: In excavations use select fill or approved excavated material. Place in layers to required subgrade elevations.

2. Building Slabs: Under building slabs use select fill as shown on the drawings. Place fill between the top of footings and mats and the building slab or the bottom of the drainage course.

3. Around Footings and Mats: Backfill around the formed edges of footings and mats with lean concrete or cement-stabilized sand.

4. Behind Foundation Walls: Behind foundation walls, use drainage fill around the wall drain and drainage backfill over the drainage fill and wall drain up to within two feet of grade. Use impervious fill material at the top 24" of the wall backfill.

5. Under Walks: Use minimum 6" deep course of base or subbase material, or approved excavated material.

6. Backfill Adjacent to Structures: Backfill against the structure with select fill up to within two feet of grade. Use impervious fill material at the top 24" of backfill adjacent to structures.

7. Under Steps: Use minimum 6" course of subbase or base material.

8. Under Piping and Conduit: Under piping and conduit use subbase or base material, shaped to fit bottom of trench.

B. Prior to Backfill Placement: Backfill excavations as promptly as work permits but not until completion of each of the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.

2. Inspection, testing, approval, and recording locations of underground utilities.

3. Removal of concrete formwork.

4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.

5. For basement walls, until floor construction at top of wall is complete.

6. Removal of trash and debris.

7. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

C. Ground Surface Preparation:

1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

2. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

D. Grading:

1. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

2. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes to the following tolerances:

   a. Lawn or Unpaved Areas: Plus or minus 1 inch.
   b. Walks: Plus or minus 1 inch.

3. Grading Surface of Fill Under Building Slabs: Provide final grades within a tolerance of 1/2" when tested with a 10' straightedge.

4. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

5. Allowance for Compaction and Settlement: Allow for natural compaction and settlement during grading operations. Where excessive settlement occurs, scarify settled areas, fill and compact to required subgrade levels.

3.5 COMPACTION

A. General: Control all soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture density relationship (cohesive soils) determined in accordance with ASTM D 698 ASTM D 1557; and not less than the following percentages of relative density, determined in accordance with ASTM D 4253 and 4254, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils). Cohesive soils are defined as those that have more than 50% of the soil material by weight passing the #200 sieve.

1. Structures, Building Slabs and Steps, and Pavements: Scarify the top 6" of subgrade. Re-compact the top six inches and compact each lift of fill material at the optimum moisture content (± 2%) to 95% maximum density for cohesive material or 85% relative density for cohesionless material. Place and compact the ½" layer of the leveling sub-base at the optimum moisture content (± 2%) to 85% relative density before placing the

moisture retarder. After installing the moisture retarder, place and compact the granular base material at the optimum moisture content (± 2%) to 85% relative density.

2. Building Slabs and Steps: Remove a minimum of * feet of existing subgrade material and replace with fill material up to the planned subgrade level. Compact each lift at the optimum moisture content (± 2%) to 95% maximum density or 85% relative density. Place and compact the ½" layer of the leveling sub-base at the optimum moisture content (± 2%) to 85% relative density before placing the moisture retarder. After installing the moisture retarder, place and compact the granular base material at the optimum moisture content (± 2%) to 85% relative density.

3. Behind Foundation Walls: Compaction requirements within five feet of the wall shall be 75% relative density. Compaction requirements outside the five-foot band shall be 85% of relative density. The moisture content shall be at optimum moisture (± 2%). The top two feet of impervious fill shall be compacted at optimum moisture content to 90% or 95% of maximum density depending on the proximity to the wall.

4. Behind Foundation Wall: Compaction requirements within five feet of the wall shall be 75% relative density for cohesionless soils and 90% maximum density for cohesive soils. Compaction requirements outside the five-foot band shall be 85% of relative density or 95% maximum density. The moisture content shall be at optimum moisture (± 2%). The top two feet of impervious fill shall be compacted at optimum moisture content to 90% or 95% of maximum density depending on the proximity to the wall.

5. Lawn or Unpaved Areas: Scarify and re-compact top 6" of subgrade and each layer of backfill or fill material at the optimum moisture content (± 2%) to 90% maximum density for cohesive soils and 85% relative density for cohesionless soils.

6. Walkways: Scarify and re-compact top 6" of subgrade and each layer of backfill or fill material at the optimum moisture content (± 2%) to 90% maximum density for cohesive material and 85% relative density for cohesionless material.

C. Moisture Control:

1. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.6 FIELD QUALITY CONTROL

A. Refer to Section entitled "Testing Laboratory Services" for required quality control testing during construction.

3.7 MAINTENANCE

A. Protection of Graded Areas:

1. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

2. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

C. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.8 DISPOSAL OF EXCESS WASTE MATERIALS

A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of it off Owner's property.

3.9 UNIT PRICES

A. Basis of Bids: Include excavation work and other earthwork necessary to produce the work required.

B. Changes in the Work: Payment for changes in earthwork will be made on the actual net volume change of foundation in place and accepted based on design dimensions shown. No additional compensation will be made for excavation, concrete fill, reinforcing, or other costs due to unauthorized over-excavating in any dimension.

C. Unit Prices: Quote Unit Prices which include full compensation for labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casing as required, dewatering, and other necessary items for complete installation. Provide Unit Prices for the following items, as set forth in the Contract conditions, which will apply in the event additions to or deductions from the Work are required and authorized by a written order from the **Design Professional** and approved by the Owner to the Contractor. Refer to Section 03 30 00 for concrete, reinforcing steel, and dowel Unit Price requirements.

1. Soil excavation, per cu. yd.

2. Rock excavation, per cu. yd.

3. Select fill material, placement, and compaction, per cu. yd.

END OF SECTION

SECTION 31 3116

TERMITE CONTROL - SOIL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Soil treatment with termiticide.

1.3 SUBMITTALS

A. Product Data: For each type of termite control product.

1. Include the EPA-Registered Label for termiticide products.

B. Qualification Data: For qualified Installer.

C. Product Certificates: For termite control products, from manufacturer.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Architect's records and include the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Termiticide brand name and manufacturer.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes used, and rates of application.
6. Areas of application.
7. Water source for application.

E. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed to apply termite control treatment and products in jurisdiction where Project is located.

B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.

C. Source Limitations: Obtain termite control products from single source.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label.

B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.6 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: Provide an EPA-Registered termiticide in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

1. Products: Available products that may be incorporated into the Work include, but are not limited to, the following:

a. BASF Corporation, Agricultural Products; Termidor.
b. Bayer Environmental Science; Premise 75.
c. FMC Corporation, Agricultural Products Group.
d. Syngenta.

2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
3. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
4. Masonry: Treat voids.
5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

SECTION 32 1216

ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Hot-mix asphalt patching.
2. Hot-mix asphalt paving.
3. Hot-mix asphalt paving overlay.
4. Asphalt surface treatments.
5. Pavement-marking paint.

1.3 DEFINITION

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: For each job mix proposed for the Work.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities, if requested.

C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each paving fabric, 12 by 12 inches minimum, if requested.

D. Qualification Data: For qualified asphalt paving mix plant, if requested.

E. Material Certificates: For each paving material, from asphalt paving mix plant, if requested.

F. Material Test Reports: For each paving material, if requested.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix plant registered with and approved by the State Department of Transportation (D.O.T.) of the state in which the Project is located.

B. Testing Agency Qualifications: Qualified according to the State Department of Transportation for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the State Department of Transportation for asphalt paving work.

1. Where the requirements of the State Department of Transportation reference specifications conflict with the requirements of this Section, the State Department of Transportation reference specifications shall govern.
2. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

D. Pre-installation Conference: Conduct conference at Project site, if requested.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
b. Review condition of subgrade and preparatory work.
c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

E. Visual Inspection: Conduct a visual inspection. The opinion of the Engineer of Record is final. Ravelling, loose aggregate, insufficient liquid asphalt coverage, unsightly and rough seams, poor craftsmanship, and indications of poor quality control on the part of the Contractor are causes for rejection of the work and remedial action.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F.
2. Tack Coat: Minimum surface temperature of 60 deg F.
3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials or 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations per State D.O.T. requirements.

B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel.

C. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel or combinations thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D 242 or AASHTO M 17, rock dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a, PG 64-22.

B. Asphalt Cement: ASTM D 3381 for viscosity-graded material or ASTM D 946 for penetration-graded material.

C. Prime Coat: ASTM D 2027, medium-curing cutback asphalt, MC-30 or MC-70.

D. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

E. Water: Potable.

F. Undersealing Asphalt: ASTM D 3141, pumping consistency.

2.3 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

B. Sand: ASTM D 1073 or AASHTO M 29, Grade Nos. 2 or 3.

C. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

D. Joint Sealant: ASTM D 6690 or AASHTO M 324, hot-applied, single-component, polymer-modified bituminous sealant.

E. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248; colors complying with FS TT-P-1952.

1. Color: As indicated.

F. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint.

1. Color: As indicated.

G. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 20 minutes.

1. Color: As indicated.

H. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.

1. Color: As indicated.

I. Glass Beads: AASHTO M 247, Type 1.

J. Concrete Wheel Stops: Precast, air-entrained concrete, 3000-psi minimum compressive strength. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.

1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

K. HDPE Wheel Stops: Solid, integrally colored, 96 percent recycled HDPE or commingled post-consumer and postindustrial recycled plastic; UV stabilized. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.

1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.
2. Adhesive: As recommended by wheel-stop manufacturer for application to asphalt pavement.

2.4 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes complying with State D.O.T. requirements and designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types."

1. Provide mixes complying with State D.O.T. requirements.
2. Provide mixes complying with composition, grading, and tolerance requirements in ASTM D 3515 for the following nominal, maximum aggregate sizes:

a. Base Course: 1 inch.
b. Surface Course: ¾ inch.

C. Emulsified-Asphalt Slurry: ASTM D 3910.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.

2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

D. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.2 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth required to install the new sealant per manufacturer's requirements.

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. After the subgrade has been thoroughly compacted, proofroll the entire subgrade area. Proofroll as specified in the Section EARTHWORK of these specifications. Remove and satisfactorily repair defective areas which pump, or shove, or are found to be soft and test roll again as specified. In defective areas, plow, harrow and mix to a depth of 6 inches minimum the entire defective subgrade as required to achieve compaction. If stabilization stone is required, mix into the subgrade at 150 LB. / SQ. YD. minimum. After the material has been thoroughly mixed, bring to line and grade the subgrade and compact to the densities for paving area fill contained in the Section EARTHWORK. Blade the surface of the finished subgrade to a smooth and uniform texture.

C. The cost of stabilization stone is additional to the Contract except where defective conditions arise due to the Contractor's methods or earthwork is unclassified.

D.. Protect the subgrade from damage and maintain it in a smooth, compact, and rut-free condition until the base course has been placed.

E. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

F. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.30 gal./sq. yd. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

G. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 PAVING GEOTEXTILE INSTALLATION

A. Apply tack coat uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd.

B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches and transverse joints 6 inches.

1. Protect paving geotextile from traffic and other damage and place hot-mix asphalt paving overlay the same day.

3.6 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at minimum temperature of 250 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.7 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.8 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927 or AASHTO T 245, but not less than 94 percent nor greater than 100 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Surface Course: 1/4 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

C. Traffic-Calming Devices: Compact and form asphalt to produce the contour indicated and within a tolerance of plus or minus 1/8 inch (3 mm) of height indicated above pavement surface.

3.10 SURFACE TREATMENTS

A. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.

1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.11 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal.

3.12 WHEEL STOPS

A. Install wheel stops as recommended by manufacturer.

B. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.13 FIELD QUALITY CONTROL

A. The Architect, at his option and at his expense, may take as many tests as necessary to determine the average thickness of the base course prior to the placing of the surface course. Calculate the average thickness of specimens. Meet the specified thickness of the base course minimum with t he average. In areas where there is a deficiency in the thickness of the course, increase in thickness the surface course to the amount of the average deficiency of the tests. The surface course may also be tested. If tests show a deficiency of ¼" or more in the surface course, place additional surface course up to one inch in thickness at no cost to the Architect and pay for the failing test.

B. Visual Inspection:

1. The Architect may conduct a visual inspection of the finish work and surface course appearances.
2. The Architect will annotate areas of rough, gravelly, or raveling asphalt, poor quality, rough or uneven seams, gouging, evidence of cold application, and other defects.
3. The Contractor and Architect will agree upon the required remedial actions needed to address the deficiencies.
4. Perform remedial work in a timely manner prior to final accep

C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course may be tested for compliance with smoothness tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

F. Replace and compact hot-mix asphalt where core tests were taken.

G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.14 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow milled materials to accumulate on-site.

END OF SECTION

SECTION 321313

CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Driveways.
2. Roadways.
3. Parking lots.
4. Curbs and gutters.
5. Walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
2. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements. For each design mixture submitted, include an equivalent concrete mixture that does not contain portland cement replacements, to determine amount of portland cement replaced.

C. Shop Drawings:

1. Joint plan, showing type and location, no smaller than the scale of the construction documents.
2. Joint details, including dowels where appropriate.

D. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection, if requested.

E. Other Action Submittals:

1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

F. Qualification Data: For qualified ready-mix concrete manufacturer if requested.

G. Material Certificates: For the following, from manufacturer, if requested:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

H. Material Test Reports: For each of the following:

1. Aggregates, if requested.

I. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

C. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

D. ACI Publications: Comply with ACI 301 unless otherwise indicated.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless the Architect specifically approves such deviations in writing.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site if requested.

1. Review methods and procedures related to concrete paving, including but not limited to, the following:

a. Concrete mixture design.
b. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete paving subcontractor.
e. Manufacturer's representative of stamped concrete paving system used for detectable warnings.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials or 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. Recycled Content: Provide steel reinforcement with an average recycled content of steel so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from steel wire into flat sheets.

C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

D. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884, Class A, plain steel.

E. Reinforcing Bars: ASTM A 615, Grade 60 (Grade 420); deformed.

F. Galvanized Reinforcing Bars: ASTM A 767, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615, Grade 60 (Grade 420) deformed bars.

G. Epoxy-Coated Reinforcing Bars: ASTM A 775 or ASTM A 934; with ASTM A 615, Grade 60 (Grade 420) deformed bars.

H. Steel Bar Mats: ASTM A 184; with ASTM A 615, Grade 60 (Grade 420), deformed bars; assembled with clips.

I. Plain-Steel Wire: ASTM A 82.

J. Deformed-Steel Wire: ASTM A 496.

K. Epoxy-Coated-Steel Wire: ASTM A 884, Class A coated.

L. Joint Dowel Bars: ASTM A 615, Grade 60 (Grade 420) plain-steel bars. Cut bars true to length with ends square and free of burrs.

M. Epoxy-Coated, Joint Dowel Bars: ASTM A 775; with ASTM A 615, Grade 60 (Grade 420), plain-steel bars.

N. Tie Bars: ASTM A 615, Grade 60 (Grade 420), deformed.

O. Hook Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

P. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

Q Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

R. Zinc Repair Material: ASTM A 780.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C 150, gray portland cement Type I or Type III. Supplement with the following as appropriate:

   a. Fly Ash: ASTM C 618, Class C or Class F.
   b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

2. Blended Hydraulic Cement: ASTM C 595 cement.

B. Normal-Weight Aggregates: ASTM C 33, uniformly graded. Provide aggregates from a single source with documented service-record data of satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: Per State Department of Transportation requirements.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:

1. Aggregate Sizes: Per State Department of Transportation requirements.

D. Water: Potable and complying with ASTM C 94.

E. Air-Entraining Admixture: ASTM C 260.

F. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

G. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

1. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ChemMasters.
b. Davis Colors.
c. Dayton Superior Corporation.
d. Elementis Pigments.
e. Hoover Color Corporation.
f. Lambert Corporation.
g. LANXESS Corporation.
h. QC Construction Products.
i. Scofield, L. M. Company.
j. Solomon Colors, Inc.
k. Stampcrete International, Ltd.
l. SureCrete Design Products.

2. Color: As selected by Architect from manufacturer's full range.

2.4 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete paving, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.

1. Products: Available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Monofilament Fibers:
      1) Axim Italcementi Group, Inc.; FIBRASOL II P.
      2) Euclid Chemical Company (The), an RPM company; Fiberstrand 100, Fiberstrand 150.
      3.) FORTA Corporation .
      4) Grace, W. R. & Co. - Conn.; Grace MicroFiber.
      5) Metalcrete Industries; Polystrand 1000.
      6) QC Construction Products; QC FIBERS.

   b. Fibrillated Fibers:

      1) Axim Italcementi Group, Inc.; FIBRASOL F.
      2) Euclid Chemical Company (The), an RPM company; Fiberstrand F.
      3) FORTA Corporation .
      4) Grace, W. R. & Co. - Conn.; Grace Fibers.
      5) Propex Concrete Systems Corp.; Fibermesh 300.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, burlap cloth made from jute or kenaf, dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

1. Products: Available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Axim Italcementi Group, Inc.; Caltexol CIMFILM.
   b. BASF Construction Chemicals, LLC; Confilm.
   c. ChemMasters; Spray-Film.
   d. Conspec by Dayton Superior; Aquafilm.
   e. Dayton Superior Corporation; Sure Film (J-74).
   f. Edoco by Dayton Superior; BurkeFilm.
   g. Euclid Chemical Company (The), an RPM company; Eucobar.
   h. Kaufman Products, Inc.; VaporAid.
   i. Lambert Corporation; LAMBCO Skin.
   j. L&M Construction Chemicals, Inc.; E-CON.
   k. Meadows, W. R., Inc.; EVAPRE.
   l. Metalcrete Industries; Waterhold.
   m. Nox-Crete Products Group; MONOFILM.
   n. Sika Corporation, Inc.; SikaFilm.
   o. SpecChem, LLC; Spec Film.
   p. Symons by Dayton Superior; Finishing Aid.
   q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
   r. Unitex; PRO-FILM.
   s. Vexcon Chemicals Inc.; Certi-Vex EnvioAssist.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. Products: Available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Anti-Hydro International, Inc.; A-H Curing Compound #2 DR WB.
    b. ChemMasters; Safe-Cure Clear.
    c. Conspec by Dayton Superior.
    d. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
    e. Edoco by Dayton Superior.
    f. Euclid Chemical Company (The), an RPM company; Kurez W VOX.
    g. Kaufman Products, Inc.; Thinfilm 420.
    h. Lambert Corporation; AQUA KURE - CLEAR.
    i. L&M Construction Chemicals, Inc.; L&M CURE R.
    j. Meadows, W. R., Inc.; 1100-CLEAR SERIES.
    k. Nox-Crete Products Group; Resin Cure E.
    l. SpecChem, LLC; PaveCure Rez.
    m. Symons by Dayton Superior; Resi-Chem Clear.
    n. Tamms Industries, Inc., Euclid Chemical Company (The); TAMMSCURE WB 30C.
    o. TK Products, Division of Sierra Corporation..
    p. Vexcon Chemicals Inc.; Certi-Vex Enviocure 100.

F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

1. Products: Available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Anti-Hydro International, Inc.; A-H Curing Compound #2 WP WB.
    b. ChemMasters; Safe-Cure 2000.
    c. Conspec by Dayton Superior .
    d. Dayton Superior Corporation; Day-Chem White Pigmented Cure (J-10-W).
    e. Edoco by Dayton Superior; Resin Emulsion Cure V.O.C. (Type II).
    f. Euclid Chemical Company (The), an RPM company; Kurez VOX White Pigmented.
    g. Kaufman Products, Inc.; Thinfilm 450.
    h. Lambert Corporation; AQUA KURE - WHITE.
    i. L&M Construction Chemicals, Inc.; L&M CURE R-2.
    j. Meadows, W. R., Inc.; 1100-WHITE SERIES.
    k. SpecChem, LLC; PaveCure Rez White.
    l. Symons by Dayton Superior; Resi-Chem White.
    m. Vexcon Chemicals Inc.; Certi-Vex Enviocure White 100.

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types I and II, non-load bearing or Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.
   1. Products: Available products that may be incorporated into the Work include, but are not limited to, the following:

      a. ChemMasters; Exposee.
      b. Conspec by Dayton Superior; Delay S.
      c. Dayton Superior Corporation; Sure Etch (J-73).
      d. Edoco by Dayton Superior; True Etch Surface Retarder.
      e. Euclid Chemical Company (The), an RPM company; Surface Retarder Formula S.
      f. Kaufman Products, Inc.; Expose.
      g. Meadows, W. R., Inc.; TOP-STOP.
      h. Metalcrete Industries; Surftard.
      i. Nox-Crete Products Group; CRETE-NOX TA.
      j. Scofield, L. M. Company; LITHOTEX Top Surface Retarder.
      k. Sika Corporation, Inc.; Rugasol-S.
      l. SpecChem, LLC; Spec Etch.
      m. TK Products, Division of Sierra Corporation; TK-6000 Concrete Surface Retarder.
      n. Unitex; TOP-ETCH Surface Retarder.
      o. Vexcon Chemicals Inc.; Certi-Vex Envioset.

F. Pigmented Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.

   1. Products: Available products that may be incorporated into the Work include, but are not limited to, the following:

      a. Anti-Hydro International, Inc.; A-H S-Q Hardener.
      b. BASF Construction Chemicals, LLC; Mastercron.
      c. ChemMasters; ConColor.
      d. Conspec by Dayton Superior; Conshake 600 Colortone.
      e. Dayton Superior Corporation; Quartz Tuff.
      f. Euclid Chemical Company (The), an RPM company; Surflex.
      g. Lambert Corporation; COLORHARD.
      h. L&M Construction Chemicals, Inc.; QUARTZPLATE FF.
      i. Metalcrete Industries; Floor Quartz.
      j. Scofield, L. M. Company; LITHOCHROME Color Hardener.
      k. Southern Color N.A., Inc.; Mosaics Color Hardener.
      l. Stampcrete International, Ltd.; Color Hardener.
      m. Symons by Dayton Superior; Hard Top.

   2. Color: As selected by Architect from manufacturer's full range.

G. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

2.7 DETECTABLE WARNING MATERIALS

A. Detectable Warning Stamp: Semirigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent hole at each dome.

1. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advanced Surfaces Inc.
b. Matcrete Precision Stamped Concrete Tools.
c. Southern Color N.A., Inc.
d. Stampcrete International Ltd.
e. Superior Decorative by Dayton Superior.

2. Size of Stamp: One piece matching detectable warning area..

B. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation designed to facilitate release of stamp mats.

1. Products: Available products that may be incorporated into the Work include, but are not limited to, the following:

a. Advanced Surfaces Inc.; Liquid Release.
b. Matcrete Precision Stamped Concrete Tools; Liquid Release Agent.
c. Southern Color N.A., Inc.; SCC Clear Liquid Release.
d. Stampcrete International Ltd.; Stampcrete Liquid Release.
e. Superior Decorative by Dayton Superior; Pro Liquid Release.

2.8 PAVEMENT MARKINGS

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, colors complying with FS TT-P-1952.

1. Color: As indicated.

B. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint.

1. Color: As indicated.

C. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II.

1. Color: As indicated.

D. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.

1. Color: As indicated.

E. Glass Beads: AASHTO M 247, Type 1.

2.9 WHEEL STOPS

A. Concrete Wheel Stops: Precast, air-entrained concrete, 3000-psi minimum compressive strength. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.

1. Dowels: Galvanized steel, 3/4 inch in diameter, 10-inch minimum length.

B. HDPE Wheel Stops: Solid, integrally colored, 96 percent recycled HDPE, or commingled post-consumer and postindustrial recycled rubber or plastic; UV stabilized. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.

1. Color: Yellow or other color as approved by Architect.
2. Dowels: Galvanized steel, 3/4 inch in diameter, 10-inch minimum length.
3. Adhesive: As recommended by wheel stop manufacturer for application to concrete pavement.

2.10 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 4000 psi.
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
3. Slump Limit: 4 inches, plus or minus 1 inch.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 4.0 to 5.5 percent..

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use admixtures in concrete as required for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Cementitious Materials: Limit percentage by weight of cementitious materials other than portland cement according to ACI 301 requirements as follows:

1. Fly Ash or Pozzolan: 25 percent.
2. Ground Granulated Blast-Furnace Slag: 50 percent.
3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

G. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate for application and performance required .

H. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94 and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd. , increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting according to requirements in Division 31.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Butt Joints: Use bonding agent or epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, buildings, and other fixed objects, and where indicated.

1. Locate expansion joints at intervals shown on the drawings.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas at maximum spacing of 15 ft. on center each way. Complete contraction jointing within twelve hours of concrete placement

E. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: As soon as concrete can be worked without raveling, form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch maximum radius. Repeat grooving of contraction joints after applying surface finishes.

   a. Tolerance: Ensure that grooved joints are within 2 inches either way from centers of dowels.

2. Sawed Joints: As soon as concrete can be worked without raveling, form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

   a. Tolerance: Ensure that sawed joints are within 2 inches either way from centers of dowels.

3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

F. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8-inch maximum radius. Repeat tooling of edges after applying surface finishes.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

M. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 SPECIAL FINISHES

A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:

1. Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

B. Seeded Exposed-Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on paving surface. Tamp aggregate into plastic concrete and float finish to entirely embed aggregate with mortar cover of 1/16 inch.

1. Spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:

1. Uniformly spread slip-resistive aggregate over paving surface at the recommended rate in two applications. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.

2. Uniformly distribute approximately two-thirds of slip-resistive aggregate over paving surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage, and embed by power floating.
3. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
4. After curing, lightly work surface with a steel wire brush or abrasive stone and water to expose nonslip aggregate.

D. Rock-Salt Finish: After initial floating, uniformly spread rock salt over paving surface at the rate of 5 lb/100 sq. ft.

1. Embed rock salt into plastic concrete with roller or float.
2. Cover paving surface with 1-mil- thick polyethylene sheet and remove sheet when concrete has hardened and seven-day curing period has elapsed.
3. After seven-day curing period, saturate concrete with water and broom-sweep surface to dissolve remaining rock salt, thereby leaving pits and holes.

E. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surface according to manufacturer's written instructions and as follows:

1. Uniformly spread dry-shake hardener at a rate recommended by manufacturer to match paving color required.
2. Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.
3. After final power floating, apply a hand-trowel finish followed by a broom finish.
4. Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.

3.9 DETECTABLE WARNINGS

A. Blockouts: Form blockouts in concrete for installation of detectable paving units specified in Division 32.

1. Tolerance for Opening Size: Plus 1/4 inch, no minus.

B. Stamped Detectable Warnings: Install stamped detectable warnings as part of a continuous concrete paving placement and according to stamp-mat manufacturer's written instructions.
1. Before using stamp mats, verify that the vent holes are unobstructed.
2. Apply liquid release agent to the concrete surface and the stamp mat.
3. Stamping: While initially finished concrete is plastic, accurately align and place stamp mats in sequence. Uniformly load, gently vibrate, and press mats into concrete to produce imprint pattern on concrete surface. Load and tamp mats directly perpendicular to the stamp-mat surface to prevent distortion in shape of domes. Press and tamp until mortar begins to come through all of the vent holes. Gently remove stamp mats.
4. Trimming: After 24 hours maximum, cut off the tips of mortar formed by the vent holes.

5. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.

3.10 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.11 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot long, unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.

8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.12 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

3.13 WHEEL STOPS

A. Install wheel stops in bed of adhesive applied as recommended by manufacturer.

B. Securely attach wheel stops to paving with not less than two galvanized-steel dowels located at one-quarter to one-third points. Install dowels in drilled holes in the paving and bond dowels to wheel stop. Recess head of dowel beneath top of wheel stop.

3.14 FIELD QUALITY CONTROL

A. Testing Agency: Architect will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 5000 sq. ft. or fraction thereof of each concrete mixture placed each day.

   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39; test one specimen at seven days and two specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.16 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 32 1413

INTERLOCKING PRECAST CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this Section includes interlocking precast concrete paving including supplementary items necessary to complete their installation.

1.2 SUBMITTALS

A. Product Data: Concrete paving and edge restraints.

B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type concrete paving indicated.

C. Samples for Verification: Full-size units of each type of concrete paving indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete paving installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations: Obtain each type of concrete paving, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

C. Mock-up: Before installing concrete paving, build mock-ups for each form and pattern of paving required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-ups to comply with the following requirements, using materials indicated for the completed Work, including same base construction, special features and contiguous work as indicated:

1. Build mock-up of size indicated or, if not indicated, a minimum of 50 square feet.
2. Notify Architect seven days in advance of dates and times when mock-up will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mock-ups before starting paving installation.
5. Maintain mock-up during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mock-up unless approved by Architect to become part of the completed Work.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect concrete paving and aggregate during storage and construction against soiling or contamination from earth and other materials.

B. Cover paving with plastic or use other packaging materials that will prevent rust marks from steel strapping.

1.5 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace concrete paving work damaged by frost or freezing.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide product by one of the following manufacturers:

1. Licensee of Symetry that markets concrete pavers in Project location.
2. Licensee of Symrah Licensing Inc. that markets concrete pavers in Project location.
3. Licensee of Uni-Group U.S.A. that markets concrete pavers in Project location.

2.2 CONCRETE PAVERS

A. Paving: Solid, interlocking concrete paving units, ASTM C 936, made from normal-weight aggregates in sizes and shapes indicated.

1. Average compressive strength of 8,000 psi with no individual unit under 7,200 psi.
2. Average absorption of 5% with no unit greater than 7% when tested in accordance with ASTM C 140.
3. Resistance to 50 freeze-thaw cycles when tested in accordance with ASTM C 67.
4. Color Pigment: ASTM C 979.
5. Size, Color and Texture: Refer to schedule at end of this section.

2.3 ACCESSORIES

A. Steel Edge Restraints: Painted commercial steel edging with loops pressed from or welded to face to receive stakes at 36 inches o.c., and steel stakes 15 inches long for each loop.

1. Size: 3/16-inch-thick by 4 inches high.

2.4 AGGREGATE SETTING-BED MATERIALS

A. Graded Aggregate for Base: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 8.

B. Geotextile: Woven or nonwoven geotextile manufactured from polyester or polypropylene fibers, with a permeability rating 10 times greater than that of soil on which paving is founded and an apparent opening size small enough to prevent passage of fines from leveling course into graded aggregate of base course below.

C. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements of ASTM C 33 for fine aggregate.

D. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 sieve and no more than 10 percent passing No. 200 sieve. Provide sand of color to match paving.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Proof-roll prepared subgrade surface to check for unstable areas and areas requiring additional compaction. Proceed with paving installation only after deficient subgrades have been corrected and are ready to receive subbase for paving.

3.3 AGGREGATE SETTING-BED

A. Compact soil subgrade uniformly to at least 95 percent of ASTM D 1557 laboratory density.

B. Place geotextile over prepared subgrade, overlapping ends and edges at least 12 inches.

C. Place aggregate base over compacted subgrade. Provide compacted thickness of 4 inches unless otherwise indicated. Compact base to 95 to 98 percent of ASTM D 1557 maximum laboratory density and screed to depth required to allow setting of paving.

D. Place leveling course and screed to a thickness of 1 to 1-1/2 inches, taking care that moisture content remains constant and density is loose and constant until paving are set and compacted.

E. Treat leveling base with soil sterilizer to inhibit growth of grass and weeds.

3.4 PAVER INSTALLATION

A. Do not use paving with chips, cracks, voids, discolorations, and other defects that might be visible or cause staining in finished work.

B. Mix paving from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut paving with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

D. Tolerances: Do not exceed 1/16-inch unit-to-unit offset from flush (lippage), nor 1/8 inch in 24 inches and 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.

E. Provide edge restraints as indicated. Install edge restraints before placing unit paving.

1. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after unit paving installation.
2. For metal edge restraints with top edge exposed, drive stakes at least 1 inch below top edge.

F. Set paving with a minimum joint width of 1/16 inch and a maximum of 1/8 inch, being careful not to disturb leveling base. If paving have spacer bars, place paving hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch with pieces cut to fit from full-size unit paving.

G. Vibrate paving into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:

1. After edge paving are installed and there is a completed surface or before surface is exposed to rain.
2. Before ending each day's work, fully compact installed concrete paving to within 36 inches of the laying face.
3. Cover open layers with nonstaining plastic sheets overlapped 48 inches on each side of the laying face to protect it from rain.

H. Spread dry sand and fill joints immediately after vibrating paving into leveling course. Vibrate paving and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.

I. Do not allow traffic on installed paving until sand has been vibrated into joints.

J. Repeat joint-filling process 30 days later.

K. Remove and replace paving that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

3.5 CONCRETE PAVING SCHEDULE

A. CP-01:

1. Manufacturer: Hanover.
2. Product: Prest Pavers.
3. Size: 12 inches by 24 inches.
4. Color: As selected.
5. Texture: Smooth.

B. CP-02A:

1. Manufacturer: Hanover.
2. Product: Prest Pavers.
3. Size: 6 inches by 12 inches
4. Color: As selected.
5. Texture: Smooth.

C. CP-02A:

1. Manufacturer: Hanover.
2. Product: Prest Pavers.
3. Size: 6 inches by 12 inches
4. Color: As selected.
5. Texture: Smooth.

END OF SECTION

SECTION 329200

TURF AND GRASSES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Provide labor, material, and equipment necessary to prepare soil, sod and seed lawns, mulch and water lawns and grasses.

1.02 QUALITY ASSURANCE

A. Sod: Comply with American Sod Producers Association (ASPA)classes of sod materials.

B. Upon request, provide and pay for materials testing by testing agency acceptable to the Owner. Provide the following data:
   1. Test representative material samples proposed for use.
   2. Topsoil:
      a. pH factor.
      b. Mechanical analysis.
      c. Percentage of organic content.
      d. Recommendation on type and quantity of additives required to establish satisfactory pH factor and supply of nutrients to bring nutrients to satisfactory level for planting.

C. Before proceeding with any work, verify dimensions and inform the Owner of any discrepancies between the drawings and specifications and actual conditions.

1.03 SUBMITTALS

A. Upon request, submit seed vendor's certification for required grass mixture, indicating percentage by weight, and percentages of purity, germination, and weed seed for each grass species.

B. Upon request, submit sod growers certification of grass species.

C. Upon request, submit the following material samples:
   1. Seed.
   2. Sod

D. Upon request, submit the following material certification:
   1. Fertilizer(s) analysis.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver seed and fertilizer materials in original unopened containers, showing weight, analysis, and name of manufacturer. Store in a manner to prevent wetting and deterioration.

B. Cut, deliver, and install sod within a 24-hour period.
   1. Do not harvest or transport sod when moisture content adversely affects sod survival.
   2. Protect sod from sun, wind, and dehydration prior to installation.
   3. Do not tear, stretch, or drop sod during handling and installation.

1.05 PROJECT CONDITIONS

A. Prepare ground surface and soil as specified, to slopes and final grades shown on drawings and necessary for drainage.

B. Work notification: Notify Owner at least 48 hours prior to start of seeding and sodding operations.

C. Protect existing utilities, paving, and other facilities from damage caused by seeding and sodding operations.

D. Perform seeding and sodding work only after planting and other work affecting ground surface had been completed.

E. For new lawn areas and existing lawn areas to be completely renovated, weeds, grass, and other plants are to be killed removed completely prior to soil preparation.

F. Restrict traffic from lawn areas until lawns and grasses are established. Erect signs and barriers as required.

G. Provide hose and lawn watering equipment as required.

1.06 WARRANTY

A. Provide a uniform stand of grass by watering, mowing, and maintaining seeded and sodded areas until final acceptance. Reseed or resod areas, with specified materials, which fail to provide a uniform stand of grass until affected areas are accepted by the Owner.

PART 2 PRODUCTS

2.01 MATERIALS

A. Lawn seed: Fresh, clean, and new crop seed mixture.

MIXTURE	PURITY	MINIMUM GERMINATION	CONDITION
Bermuda	97%	85%	Hulled, Coated
Fescue	97%	85%	Coated
Rye	97%	85%	Coated

Provide

Sod type: Late May to September - Certified Bermuda Sod (Cynodon dactylon Hybrid)
Late September to April - Festuca arundinacea Fescue

2. Furnish sod machine stripped and of Supplier's standard width, length, and thickness: Uniformly 1" to 1-1/2" thick with clean cut edges. Mow sod before stripping.

C. Fertilizer:
1. Granular, non-burning product composed of not less than 50% organic, slow acting, guaranteed analysis professional fertilizer.
   a. Starter fertilizer: (Type A) Fescues and Bermudas: 8% N - 24% P - 10% K (by weight)
   b. Top dressing fertilizer: (Type B) Fescues and Bermudas: 10% N - 10% P - 10%K

D. Straw Mulch: Clean oat, wheat or fescue straw, well seasoned before baling, free from seed-bearing stalks, or roots or noxious weeds, finely ground.

E. Wood cellulose fiber mulch: Degradable green dyed wood cellulose fiber or 100% recycled long fiber pulp, free from weed or other foreign matter toxic to seed germination and suitable for hydro mulching.

F. Water: Free of substance harmful to seed growth. Furnish hoses or other methods of transport.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine finish surfaces, grades, topsoil quality, and depth. Do not start seed and sodding work until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Limit preparation to areas which will be immediately seeded or sodded.

B. Loosen topsoil of lawn areas to minimum depth of 4". Remove stones over 1" in any dimension and sticks, roots, rubbish, and extraneous matter.

C. Grade lawn areas to a smooth, free draining even surface with loose, moderately coarse texture. Roll and rake, remove ridges, and fill depressions as required to drain.

D. Apply Type A fertilizer at the rate equal to 1.0 lb. of actual nitrogen per 1,000 sq. ft. (12.5 lbs./1000 SF or 545 lbs./acre). Apply fertilizer by mechanical rotary or drop type distributor, thoroughly and evenly incorporated with the soil to a depth of 3" by discing or other approved method. Fertilize areas inaccessible to power equipment with hand tools and incorporate it into soil.

E. Dampen dry soil prior to sodding.

F. Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to sodding.

3.03 INSTALLATION

A. Seeding for turf (lawn) areas
   1. Seed immediately after preparation of bed:
      Bermuda: April 15 to August 31
      Rebel II Fescue: September 1 to November 15 and April 15 to May 15.
      Rye (temporary): November 15 to April 15.
   2. Seed indicated areas within contract limits and areas adjoining contract limits disturbed as a result of landscape construction operations.
   3. Perform seeding operations when the soil is workably dry and when winds do not exceed five (5) miles per hour velocity.
   4. Apply seed with a rotary or drop type distributor. Sow seed evenly in equal quantities in two (2) directions, at right angles to each other.
   5. Sow fescue grass seed at the rate of 6 lbs. / 1000 SF or 275 lbs/acre. Sow Bermuda grass seed at the rate of 2 lbs. / 1000 SF or 90 lbs. / acre.
   6. After seeding, rake or drag surface of soil lightly to incorporate seed into top 1/8" of soil. Roll with light lawn roller.

7. Apply seedless, finely ground wheat or fescue straw mulch to fescue seeded areas, sufficient to cover but not more than 1/2" thick so as not to smother germinating grass. Do not mulch bermuda grassed areas more than ¼" thick.
8. Water the seeded area after completing seeding operations. Do not allow soil surface to dry out after beginning to water for at least 30 days. This may require watering more than once a day.

B. Sodding
1. Lay sod to form a solid mass with tightly-fitted joints. Butt ends and sides of sod strips. Do not overlay edges. Stagger strips to offset joints in adjacent courses. Remove excess sod to avoid smothering of adjacent grass. Provide sod pad top flush with adjacent curbs, sidewalks, drains, and seeded areas.
2. Do not lay dormant sod. Do not place sod on saturated or frozen soil.
3. Place initial row of sod in a straight line, beginning at bottom of slopes, perpendicular to direction of the sloped area. Place subsequent rows parallel to and lightly against previously installed row.
4. Peg sod on slopes 3:1 and greater to prevent slippage at a rate of 2 stakes per yd. of sod.
5. Water sod thoroughly with a fine spray immediately after laying.
6. Roll with light lawn roller to ensure contact with sub-grade.

3.04 MAINTENANCE

A. Maintain seeded lawns until completion and acceptance of the entire project.

B. Maintain seeded lawn areas, including watering, spot weeding, mowing, application of herbicides, fungicides, insecticides, and re-seeding until a full, uniform stand of grass free of weeds, undesirable grass species, disease, and insects is achieved and accepted by the Owner.

1. Water to maintain adequate surface soil moisture for proper seed germination. Continue daily or more frequent watering if needed for not less than 30 days. Thereafter apply adequate amount of water to maintain until acceptance.
2. Repair, rework, and re-seed areas that have washed out, or are eroded. Replace undesirable or dead areas with new seed.
3. Apply Type B fertilizer to lawns approximately 30 days after seeding at a rate equal to 1.0 lb. of actual nitrogen per 1,000 sq. ft. (10 lbs. / 1000 SF or 430 lbs. / acre). Thoroughly water into soil.

C. Maintain sodded lawns until completion and acceptance of the entire project.

D. Maintain sodded lawn areas, including watering, spot weeding, mowing, application of herbicides, fungicides, insecticides and resodding until a full, uniform stand of grass free of weed, undesirable grass species, disease, and insects is achieved and accepted by the Owner.
1. Water sod thoroughly every 1 to 2 days, and as required to establish proper rooting.
2. Repair, rework, and resod areas that have washed out or are eroded. Replace undesirable or dead areas with new sod.
3. Apply Type B fertilizer to lawns approximately 30 days after sodding at a rate equal to 1.0 lb. of actual nitrogen per 1,000 sq. ft. (10 lbs. / 1000 SF or 430 lbs. / acre). Apply with a mechanical rotary or drop type distributor. Thoroughly water into soil.

E. Mow fescue lawn areas as soon as lawn top growth reaches a 3" height. Cut back to 2 ½" height. Mow Bermuda lawn areas as soon as top growth reaches a 2" height. Cut back to 1-1/2" height. Repeat mowing no less than once every seven days as required to maintain specified height. Do not cut off more than 30% of grass leaf at any single mowing. Mow Bermuda with a reel mower. Remove grass clippings.

F. Apply herbicides per manufacturer's recommendations as required to control weed growth or undesirable grass species.

G. Apply fungicides and insecticides per manufacturer's recommendations as required to control diseases and insects.

3.05 ACCEPTANCE

A. Inspection to determine acceptance of seeded lawns will be made by the Owner, upon your request. Provide notification at least 48 hours before requested inspection date.
   1. The Owner will accept seeded areas provided requirements, including maintenance, have been complied with, and a healthy, uniform, close stand of the specified grass is established free of weeds, undesirable grass species, disease, and insects.
   2. No bare or eroded spots, or thin, sparce cover totaling more than 2% of the individual areas, in areas inspected, will be accepted.

B. Upon acceptance, the Owner will assume lawn maintenance.

C. Inspection to determine acceptance of sodded lawns will be made by the Owner. Provide notification at least 48 hours before inspection date.
   1. The Owner will accept sodded areas provided requirements, including maintenance, have been complied with, and a healthy, even colored, viable lawn is established, free of weeds, undesirable grass species, disease, and insects.
   2. Loose, ragged edges or un-rooted strips and patches will not be accepted.

3.06 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site excess materials, debris, and equipment. Repair damage resulting from sodding and seeding operations.

END OF SECTION 329200

GEORGIA STATE FINANCING AND INVESTMENT COMMISSION
Building Expansion Lanier Technical College – TCSG 236
Dawsonville, Georgia

SECTION 329300

PLANTS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide labor, material, and equipment necessary to install trees and shrubs, groundcovers and appurtenances.

B. Visit the site and become familiar with existing conditions. Accept final rough grades prior to commencing finished grading.

C. Provide finish grades as shown on plans and as required to achieve positive drainage of landscape beds away from building and sidewalks and toward drainage structures.

1.2 DRAWINGS AND SPECIFICATIONS

A. Drawings and Specifications prepared for this project by the Owner are a part of the contract as are any duly authorized and issued addenda to the Drawings and/or Specifications.

B. Materials shown on Drawings and/or Specification but not necessarily included in both are required as though included in both. Provide materials shown on Drawings, whether noted or not. Immediately notify the Owner of any discrepancies between plans and planting lists.

1.3 EXPERIENCE

A. Perform work specified in this document with personnel experienced in the planting and maintenance of lawns, trees, shrubs, and ground cover and adequate equipment and resources to perform the work specified herein. Do not work when the ground is frozen, too wet or under other unfavorable conditions.

1.4 APPROVAL AND SELECTION OF MATERIAL AND WORK

A. The selection of materials and the execution of operations required under the specifications and drawings are subject to the approval of the Owner who has the right to reject any materials and any work which, in his opinion, does not meet the requirements of the Contract Documents during any stage of construction. Remove rejected materials from the site.

1.5 SUBMITTALS

A. As a condition of the Contract, provide unit prices for plant materials as described in the itemized Bid Form, attached to the end of this section. Unit prices will be used by the Owner to make adjustments to the Landscaping.

B. Provide the Owner with two (2) complete bound copies of written instructions for the prescribed maintenance of the landscaping, as a condition for final acceptance.

1.6 ACTIVE UTILITIES

A. There may be active utilities located within the limits of work. Before commencing any work required under the contract, locate utilities, subsurface drainage, and underground construction so that proper precautions are taken not to disturb or damage any subsurface improvements.

Make repairs to damaged utilities resulting from the work covered by this contract at no cost to the Owner.

1.7 LAYOUT WORK

A. Before any lawn or planting is begun, stake out work in accordance with the plan. Call to the attention of the Owner and clarify any discrepancies.

1.8 PROTECTION OF ADJACENT PROPERTY

A. For the duration of the construction and until contract release, protect adjoining property from any excessive drainage and debris from the site.

B. Grass disturbed areas, unless otherwise shown.

1.9 TEMPORARY FACILITIES

A. Erect signs only with permission of the Owner.

1.10 PROTECTION AND CLEAN UP

A. Keep existing streets, driveways, and walks free from debris and mud during construction.

B. Protect site drives, curbs, walks, slabs and equipment from damage by machinery or personnel during execution of the work.

C. Upon completion of the project, remove temporary structures, materials, equipment, and debris. Sweep and wash clean concrete walks and other hard surface areas.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. Agency Standards: Use plant material true to name and size and in conformity with the following standards:

1. American Standard for Nursery Stock ANSI Z60.1-1996, Copyright 1997, (Published by the American Association of Nurserymen, Inc. 1250 I Street, NW, Suite 500, Washington, D.C., 20005).

B. Plant List: A complete list of plants, including a schedule of quantities, sizes and other requirements is shown on the Drawings. In the event that discrepancies occur between the quantities of plants indicated in the plant list and as indicated on the plan, the plan governs.

C. In sloped areas, contractor is responsible for adjusting quantities to maintain fall coverage of areas at specified plant spacing.

D. Substitutions: No substitutions will be accepted in size or type, except with the written permission of the Owner. Upon submission of written proof that a plant is not obtainable. Procure a change order, without increase in contract price, if authorized by the Owner, providing for use of nearest equivalent size or variety of plant having same essential characteristics.

E. Quality and Size

1. Use nursery grown plants, freshly dug or grown in containers of size specified for a minimum period of three months prior to purchase, normally shaped, and well branched, with full foliage when in leaf and healthy, well-developed root systems, self-supporting, with straight trunks and with leaders intact. Use plants free of injuries and bruises, insect infestations or their eggs.
2. Use plants true to species and variety. Measure before pruning, with branches in normal position. Do necessary pruning only at the time of planting. Meet requirements for the measurements, branching, grading, quality, balling, and burlapping of plants in the plant list following the code of standards currently recommended by the American Association of Nurserymen, Inc., in "American Standard for Nursery Stock".
3. Use balled and burlapped plants containing in the ball as much undisturbed soil, and as many fibrous roots as possible. Secure and tightly wrap root and soil with burlap and hold the burlap in place with cord. Handle balled and burlapped plants in a manner which will neither loosen the ball nor damage the plants. Plants having loose earth balls will be rejected.
4. No heeled in plants, or plants from cold storage will be accepted, except upon written approval of the Owner. Match plants used where symmetry is required as nearly as possible. Substitute only with written permission from the Owner.

F. Measurements

1. Conform to size and grading standards of the American Association of Nurserymen unless otherwise specified. Dimension a plant as it stands in its natural position. Provide stock of a fair average between the minimum and maximum size specified. Large plants which have been cut back to the specified size will not be accepted.
2. Measure the height and spread of plants and height of the tree trunk to foliage line with the branches in their normal positions. Measure the caliper of trees six inches above the surface of the ground.
3. Provide plants larger than specified in the Plant List at no additional cost if approved by the Owner. Increase the diameter of the ball and spread of the roots proportionately.

2.2 TOPSOIL

A. If topsoil is necessary for planting of lawns and groundcover beds in excess of that available on the site, import natural, fertile, friable soil possessing characteristics of representative productive soils in the vicinity.

B. Use topsoil free from subsoil, gravel, hardpan, Japanese beetles, fire ants, and white fringed beetles; and reasonably free from clay lumps, debris of every description, stones, rocks larger than one inch in any dimension, roots longer than 6" or larger than ½ inch in diameter, toxic amounts of acidic and alkaline substances, and other substances which would interfere with mixing, planting, and maintenance.

2.3 PLANTING SOIL FOR SHRUBS AND TREES

A. Use soil consisting of 1/3 excavated parent soil dug for shrubs and trees, cleaned of debris and stockpiled, 1/3 Peat Moss or Compost, and 1/3 dark organic Sandy Clay loam. Blend thoroughly. Stockpile this material and clean of gross debris. Break large chunks into granular size.

2.4 PEAT MOSS

A. For annual areas, use imported Canadian Sphagnum Peat Moss, or Pine Bark Humus, brown, low in content of woody material, and free of mineral matter harmful to plant life. Peat moss to have an acid reaction of about 4.0 to 5.0 pH. Thoroughly pulverize and moisten peat moss before use.

2.5 MULCH

A. Use pinestraw free from noxious weed seed, fire ants and Japanese beetles, and sticks, that is clean, dry, and freshly baled, not rotten or crumbly

2.6 LIME

A. For grassed areas only, use ground Dolomitic limestone not less than eighty five percent (85%) total carbonates and magnesium. If necessary, broadcast Limestone on the areas to be planted, to correct the pH range of the soil for proper plant and grass growth.

2.7 COMMERCIAL FERTILIZER

A. Use Commercial Fertilizer of the type of fertilizer produced for annuals, shrubs and trees. Apply fertilizer according to manufacturer's specifications.

Annuals	Osmocote	14-14-14
Shrubs	Osmocote	14-14-14
Trees	Agriform	14-14-14
Groundcover	Agriform	14-14-14

2.08 WATER

A. Provide the water required for the execution of work including maintenance until work under this contract has been completed.

2.09 MATERIALS FOR GUYING AND WRAPPING

A. Use ground anchors for anchoring guy wires of four inch (4") stamped iron, #3 steel rebar or solid, undecayed wood stakes as shown in details.

B. Use double strands of twelve (12) gauge, pliable, galvanized steel wire or, woven polypropylene material, white in color, flat, ¾" wide for guys, or for fastening trees to stakes. Arbortie or approved equal will also be accepted.

C. Hose to encase guy wires : 2 ply reinforced rubber garden hose, not less than one-half inch (½") diameter, new or used, black in color. Arbortie or approved equal will also be accepted.

2.10 HERBICIDE

A. Use Herbicides approved by the Owner. The Landscape Contractor is responsible for any damage or cost incurred from herbicide use.

PART 3 - EXECUTION

3.1 FINE GRADING

A. Prior to the Landscape Contractor's involvement, prepare rough grades to meet the specifications, uniformly leveled, and positive drainage provided with abrupt changes in slopes rounded off. The Landscape Contractor is responsible for fine grading related to landscape installation.

B. Loosen the subgrade soil to a depth of six inches (6") and grade to remove ridges and depressions so that it will be everywhere parallel to the prepared finished graded. Remove stones over two inches (2") in dimension, sticks, rubbish and other extraneous matter during this operation. Do not move heavy objects except lawn rollers over the lawn areas after the subgrade soil has been loosened and prepared as specified. Where topsoil is stockpiled for spreading, spread topsoil over the lawn areas adjacent to the new building and pavement and compact with no object heavier than lawn rollers on top of prepared subgrade.

C. Fine grade throughout the site. Assure drainage away from the building and into the drainage structures. Hand grade and shape disturbed areas and areas to be planted. Maintain surfaces to indicated finished grades and grade to take care of any settlement.

3.2 PREPARATION OF PLANTS

A. In preparing plants for moving, take precautions customary in good trade practice. Workmanship that fails to meet industry standards will not be accepted. Dig plants to retain as many fibrous roots as possible. Dig plants immediately before moving unless otherwise specified.

B. Use balled and burlapped, "B&B", plants having a solid ball of earth of minimum specified size held in place securely by burlap and a stout rope. Oversize or exceptionally heavy plants are acceptable in size if the ball or spread of the roots is proportionately increased to the satisfaction of the Owner. Broken, loose, or mutilated balls will be rejected.

C. Container-grown plants: Provide container grown plants with well established root systems sufficient to hold earth together after removal from container, but not root bound, grown for at least three (3) months in container with inside diameter designated in Schedule of Plant Materials.

3.3 DELIVERY

A. Pack, transport and handle plants with utmost care to insure adequate protection against injury. Water plants prior to shipping and do not allow to dry out.

3.4 STORAGE OF MATERIALS

A. Cover balls of "B&B" plants and containers of container grown plants which cannot be planted immediately upon delivery with moist mulch to protect from drying. Plant or heel in plants immediately upon delivery. Water plants as often as necessary to prevent drying until planting.

3.5 INSPECTION

A. Do not plant any plant material until it is inspected and approved by the Owner at the site of the project. The Owner is the sole judge of the quality and acceptability of the materials. Remove rejected material immediately from the site and replace with acceptable material at no additional cost.

3.6 WRAPPING AND GUYING DETAILS

A. Materials used in wrapping, guying protection, specified herein.

3.7 PLANTING OF TREES, SHRUBS AND GROUNDCOVERS

A. Time of Planting: Start planting when other divisions of this work including placing of topsoil to finished grade, has progressed sufficiently to permit planting. In open areas, finished grade is defined as being within one tenth (1/10) of one foot of those grades shown on the grading plans. Exercise caution not to disturb or damage existing lawn areas. Thereafter, conduct planting operations under favorable weather conditions during the next season or seasons which are normal for work as determined by accepted practice in the locality of the project. Conduct planting operations under unseasonable conditions without additional compensation.

B. Layout: Locate planting where it is shown on the plan except where obstructions overhead or below ground are encountered or where changes have been made in construction. Prior to the excavation of planting area or plant pits, or placing tree stakes, ascertain the location of utility lines, electric cables, sprinkling systems, and conduits so that proper precautions are taken not to disturb or damage any sub-surface improvements. When obstructions are found, promptly notify the Owner who will arrange to relocate the plant material. Obtain approval by the Owner for necessary adjustments.

C. Setting Plants

1. Plant each plant in an individual hole as specified for trees, shrubs, and ground covers. Dig holes with straight vertical sides and flat bottoms, or as directed. Dig the hole width for shrubs and trees a minimum of twice the diameter of the root ball, depth 6" deeper than the root ball, and loosen subgrade at the bottom of the hole an additional 6" depth. Scarify th sides of the hole.
2. Remove containers and loosen roots before setting container-grown plants in holes.
3. Set plants so that when settled, they will bear the same relation to the required finished grades as they bore to the natural grades before transplanting. Plant each plant in the center of the pit. Set plants plumb and brace rigidly in position until the planting soil has been tamped solidly around the ball of roots. Do not stomp on root balls to straighten or settle the plant. Do not place soil over the top of the roots or around the trunk collar of trees.
4. Remove ropes, wires and stakes from the top 1/3 of the root ball before filling in, unless otherwise directed by the Owner. Properly cut burlap ropes, and strings and remove from the top of the ball. When depth is specified, measure depth below finished grade.
5. Do not fill around trunk or stems.

D. Backfilling of Planting Pits and Planting Beds

1. Place excavated parent soil stockpiled from shrubs and tree holes back in the holes. Lightly tamp and water this soil so as to remove air pockets. If augers are used for hole digging, scar the side of these holes with a shovel. When the pit is nearly filled, water thoroughly and allow water to soak away. If settling of the backfill occurs after watering, add more backfill to bring to level. Form a shallow saucer around each plant by placing a ridge of topsoil around the edge of each pit.

2. Fertilizer: For annuals and ground cover areas, mix fertilizer into soil when soil is loosened. For shrubs and trees, mix fertilizer into excavated parent soil.

E. Planting Trees: Plant trees before surrounding smaller plants and groundcovers are in place. Position trees as indicated on the drawing. Where spacing dimensions or locations are not clear, notify the Owner before installation.

F. Planting Shrubs: Plant on centers as indicated with quantities adjusted if necessary to evenly fill bed using specified spacing of plants.

G. Planting Groundcovers: Plant in beds having a minimum of eight inch (4") depth of prepared soil mixture. Prepared soil mixture to consist of 75% topsoil thoroughly mixed with 25% organic mulch (ground pine bark with particles 1/4" and smaller in size) ten pounds of 5-10-5 fertilizer per 1000 square feet and work into soil mixture. Rake beds smooth. Clear rocks and other debris. Space plants as indicated on plan. In case of insufficient quantity, notify the Owner. Mulch and water immediately after planting.

H. Mulching: Within two days after planting, place a layer of commercial pinestraw minimum three inches (3") thick on the finished grade about plants. Completely cover shrub beds with a similar material.

I. Smooth planting areas to conform to specified grades after full settlement has occurred and prior to application of mulch.

J. Guying, Staking: Support trees immediately after planting. Support trees as shown in details or another method preferred by the Contractor, first approved by the Owner. Stand plants plumb after staking in accordance with the detail drawings.

1. Guying: Use three (3) guys equally spaced as shown on detail for trees over two (2) inches in caliper.

K. Watering: Thoroughly water each plant immediately following planting. Water as needed for the time period covered by guarantees.

L. Pruning and Repair: Prune plants neatly as instructed to preserve the natural character of the plants and in a manner appropriate to the particular requirements of each plant, and to the satisfaction of the Owner. Remove broken or badly bruised branches with a clean cut. Use sharp tools for pruning in accordance with instructions of the Landscape Architect. Promptly treat accidental damage to trees and shrubs occurring during the course of planting operations which is not so great as to necessitate removal of a branch or replacement of a plant as required in accordance with recognized horticultural practices and the instructions of the Owner.

3.8 MAINTENANCE

A. Repair and maintain guy wires upon completion of planting and to the end of the guarantee period. Guy wires are not to be tight. Maintain 1" slack minimum to allow trees to have the ability to move in windy conditions. Inspect the project monthly during the guarantee period and immediately notify the Owner of any irregularities or deficiencies which will affect his guarantee. Submit in writing recommended changes to the maintenance to the Owner.

B. Reset any plants to upright position or to proper grade, and remove and replace any dead plant material.

C. Protect planting areas and plants against trespassing and damages of any kind for the duration of the maintenance period. If any plants become damaged or injured, treat or replace as directed by the Owner at no additional cost to the Owner. Do not work within, adjacent to, or over any plant or planting area without proper safe-guards and protection to the plant material. If

planting is performed after grass area preparation, provide proper protection to grass areas and repair any damage resulting from planting operations as necessary at no cost to the Owner.

D. Keep sidewalks, streets, and other paved areas clean when planting and maintenance operations are in progress.

3.9 GUARANTEE

A. Guarantee plants to remain alive and healthy for one year and any replacements for an additional one year beginning at the time of replacement. The one year guarantee period shall begin at the date of final owner acceptance.

3.10 INSPECTION FOR BEGINNING THE GUARANTEE PERIOD

A. The Owner will inspect the planting work to determine its completion for beginning of the guarantee period upon notice requesting inspection at least three (3) days prior to the anticipated date. Planting must be alive and healthy in order to be considered complete. Upon acceptance of the work in total, the responsibility of the Landscape Contractor for maintenance exclusive of replacement will be terminated unless the maintenance agreement is accepted by the Owner.

3.11 FINAL INSPECTION AND REPLACEMENTS

A. Final inspections will be made at the conclusion of the guarantee period by the Owner. No plants will be accepted unless they are alive and healthy. Replace any plants which are dead, or, in the opinion of the Owner, are in an unhealthy or unsightly condition, and/or have lost their natural shape due to dead branches at no cost to the Owner.

END OF SECTION 329300

SECTION 33 0500

COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01.

1.2 SUMMARY

A. This Section includes the following:

1. Piping joining materials.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Identification devices.
6. Grout.
7. Flowable fill.
8. Piped utility demolition.
9. Piping system common requirements.
10. Equipment installation common requirements.
11. Painting.
12. Metal supports and anchorages.

1.3 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

C. ABS: Acrylonitrile-butadiene-styrene plastic.

D. CPVC: Chlorinated polyvinyl chloride plastic.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Dielectric fittings.
2. Identification devices.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

E. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.2 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings NPS 1-1/2 and Smaller:

1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
2. Aboveground Piping: Specified piping system fitting.

C. AWWA Transition Couplings NPS 2 and Larger:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cascade Waterworks Mfg. Co.
   b. Dresser, Inc.; DMD Div.
   c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
   d. JCM Industries.
   e. Smith-Blair, Inc.
   f. Viking Johnson.

2. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. Plastic-to-Metal Transition Fittings:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Spears Manufacturing Co.

2. Description: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.

E. Plastic-to-Metal Transition Unions:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Colonial Engineering, Inc.
   b. NIBCO INC.
   c. Spears Manufacturing Co.

2. Description: MSS SP-107, CPVC and PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cascade Waterworks Mfg. Co.
   b. Fernco, Inc.
   c. Mission Rubber Company.
   d. Plastic Oddities.

2. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.3 DIELECTRIC FITTINGS

A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Epco Sales, Inc.
   d. Hart Industries, International, Inc.
   e. Watts Water Technologies, Inc.
   f. Zurn Plumbing Products Group; Wilkins Div.

2. Description: Factory fabricated, union, NPS 2 and smaller.

   a. Pressure Rating: 250 psig at 180 deg F.
   b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Epco Sales, Inc.
   d. Watts Water Technologies, Inc.

2. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.

   a. Pressure Rating: 300 psig.
   b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Central Plastics Company.
   d. Pipeline Seal and Insulator, Inc.

2. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 and larger.

   a. Pressure Rating: 150 psig minimum.
   b. Gasket: Neoprene or phenolic.
   c. Bolt Sleeves: Phenolic or polyethylene.
   d. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Calpico, Inc.
   b. Lochinvar Corporation.

2. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 and smaller.

   a. Pressure Rating: 300 psig at 225 deg F.
   b. End Connections: Threaded.

F. Dielectric Nipples:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Perfection Corporation.
   b. Precision Plumbing Products, Inc.
   c. Victaulic Company.

2. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.

   a. Pressure Rating: 300 psig at 225 deg F.
   b. End Connections: Threaded or grooved.

2.4 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Division 22.

B. Steel Pipe Sleeves: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

D. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

2.5 IDENTIFICATION DEVICES

A. General: Products specified are for applications referenced in other Division 33 Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.

C. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches for ducts, and 3/4 inch for access door signs and similar operational instructions.

1. Material: Fiberboard or Brass.
2. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.

F. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.

G. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.

H. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

I. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.

1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

J. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

1. Material: 0.032-inch-thick, polished brass or aluminum.
2. Material: 0.0375-inch-thick stainless steel.
3. Material: 3/32-inch-thick plastic laminate with 2 black surfaces and a white inner layer.
4. Material: Valve manufacturer's standard solid plastic.
5. Size: 1-1/2 inches in diameter, unless otherwise indicated.
6. Shape: As indicated for each piping system.

K. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

L. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
3. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

M. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6. Terminology: Match schedules as closely as possible. Include the following:
    a. Name and plan number.
    b. Equipment service.
    c. Design capacity.
    d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

N. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.

1. Size: 3-1/4 by 5-5/8 inches.
2. Fasteners: Brass grommets and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

2.6 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.7 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.

1. Cement: ASTM C 150, Type I, portland.
2. Density: 115- to 145-lb/cu. ft..
3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
4. Aggregates: ASTM C 33, natural sand, fine.
5. Admixture: ASTM C 618, fly-ash mineral.
6. Water: Comply with ASTM C 94.
7. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Refer to Division 01 and Division 02 for general demolition requirements and procedures.

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 DIELECTRIC FITTING APPLICATIONS

A. Dry Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric unions.
2. NPS 2-1/2 to NPS 12: Dielectric flanges or dielectric flange kits.

B. Wet Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric couplings or dielectric nipples.
2. NPS 2-1/2 to NPS 4: Dielectric nipples.

3. NPS 2-1/2 to NPS 8: Dielectric nipples or dielectric flange kits.
4. NPS 10 and NPS 12: Dielectric flange kits.

3.3 PIPING INSTALLATION

A. Install piping according to the following requirements and Division 33 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Sleeves are not required for core-drilled holes.

J. Permanent sleeves are not required for holes formed by removable PE sleeves.

K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

    a. PVC Pipe Sleeves: For pipes smaller than NPS 6.
    b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

L. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections for roughing-in requirements.

3.4 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 33 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

H. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.

I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. CPVC Piping: Join according to ASTM D 2846 Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.5 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

3.6 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.7 PAINTING

A. Painting of piped utility systems, equipment, and components is specified in Division 09 painting Sections.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.
2. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
3. Locate pipe markers on exposed piping according to the following:

a. Near each valve and control device.
b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
d. At manholes and similar access points that permit view of concealed piping.
e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches, 1/2 inch high for distances up to 72 inches, and proportionately larger lettering for

greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.

2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.10 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

SECTION 33 1100

FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, apply to this Section.

1.2 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for domestic water service and fire-service mains.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

C. Provide labor, material, and equipment for the construction of the water distribution system as shown on the drawings from taps to the public system to building plumbing connection.

D. Testing and disinfection of the installed system is incidental to the work.

E. Provide construction staking in accordance with generally accepted practice for layout of underground utilities.

F. The work includes coordination with building plumbing Contractors and building plumbing plans.

G. Coordinate responsibilities for installation of meters, vaults, check valves, backflow preventors, taps, valves and appurtenances with the local jurisdiction.

H. Identify fees related to water main installation and clarify prior to bid submittal whether tap, meter, and other fees will be paid by the Owner or by the Contractor. Identify fees for installation of water services and provide a written report to the Architect.

1.3 DEFINITIONS

A. ASME: American Society of Mechanical Engineers.

B. ASSE: American Society of Safety Engineers.

C. ASTM: American Society for Testing and Materials.

D. AWWA: American Water Works Associateion.

E. DIP: Ductile Iron Pipe.

F. EPDM: Ethylene propylene diene terpolymer rubber.

G. FDA: Food and Drug Administration.

H. FM: Factory Mutual.

I. FMG: Factory Mutual Global.

J. MSS: Manufacturer's Standardization Society.

K. NFPA: National Fire Protection Association.

L. NPS: Nominal Pipe Size.

M. NSF: National Science Foundation.

O. OS&Y: Open Stem and Yoke.

P. PVC: Polyvinyl chloride plastic.

Q. UL: Underwriter's Laboratory.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

1. Wiring Diagrams: Power, signal, and control wiring for alarms.

C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include coordination of tapping of water mains and backflow prevention.
2. Comply with industry standards for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of state fire marshal for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, and marked for intended use.

D. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

G. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping.
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Owner in writing no fewer than two days in advance of proposed interruption of service.

1.8 COORDINATION

A. Coordinate connection to water main with utility company.

B. Coordinate installation of the water distribution system with grading and paving operations.

C. Provide water mains when grade is within 6 inches of final grade and prior to paving base installation.

D. After completion and testing of the water distribution system, provide the Architect with the Contractor's Material and Test Certificates required by the National Fire Protection Association.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

C. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.

1. Grooved-End, Ductile-Iron Pipe Appurtenances:

a. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Anvil International, Inc.
2) Victaulic Company of America.

b. Grooved-End, Ductile-Iron Fittings: ASTM A 47, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
c. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

D. Flanges: ASME 16.1, Class 125, cast iron.

2.2 SPECIAL PIPE FITTINGS

A. Ductile-Iron Rigid Expansion Joints:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. EBAA Iron, Inc.
b. U.S. Pipe and Foundry Company.

2. Description: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with

AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

a. Pressure Rating: 250 psig minimum.

B. Ductile-Iron Flexible Expansion Joints:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. EBAA Iron, Inc.
b. Hays Fluid Controls; a division of ROMAC Industries Inc.
c. Star Pipe Products.

2. Description: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

a. Pressure Rating: 250 psig minimum.

C. Ductile-Iron Deflection Fittings:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. EBAA Iron, Inc.

2. Description: Compound, ductile-iron coupling fitting with sleeve and 1 or 2 flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

a. Pressure Rating: 250 psig minimum.

2.3 JOINING MATERIALS

A. Refer to Division 22 for commonly used joining materials.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.4 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cascade Waterworks Manufacturing.
   b. Dresser, Inc.; Dresser Piping Specialties.
   c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
   d. Hays Fluid Controls; a division of ROMAC Industries Inc.
   e. JCM Industries.
   f. Smith-Blair, Inc.
   g. Viking Johnson.

2. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.

   a. Standard: AWWA C219.
   b. Center-Sleeve Material: Manufacturer's standard.
   c. Gasket Material: Natural or synthetic rubber.
   d. Pressure Rating: 200 psig minimum.
   e. Metal Component Finish: Corrosion-resistant coating or material.

C. Split-Sleeve Pipe Couplings:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Victaulic Depend-O-Lok.

2. Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.

   a. Standard: AWWA C219.
   b. Sleeve Material: Manufacturer's standard.
   c. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
   d. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
   e. Pressure Rating: 200 psig minimum.
   f. Metal Component Finish: Corrosion-resistant coating or material.

D. Flexible Connectors:

1. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.
2. Ferrous-Metal Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.

E. Dielectric Fittings: Combination of copper alloy and ferrous; threaded, solder, or plain end types; and matching piping system materials.

1. Dielectric Unions: Factory-fabricated union assembly, designed for 250-psig minimum working pressure at 180 deg F. Include insulating material that isolates dissimilar metals and ends with inside threads according to ASME B1.20.1.
2. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 150- or 300-psig minimum working pressure to suit system pressures.

3. Dielectric-Flange Insulation Kits: Field-assembled companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

   a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure to suit system pressures.

4. Dielectric Couplings: Galvanized-steel couplings with inert and noncorrosive thermoplastic lining, with threaded ends and 300-psig minimum working pressure at 225 deg F.
5. Dielectric Nipples: Electroplated steel nipples with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved end types, and 300-psig minimum working pressure at 225 deg F.

2.5 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. American AVK Co.; Valves & Fittings Div.
   b. American Cast Iron Pipe Co.; American Flow Control Div.
   c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
   d. Crane Co.; Crane Valve Group; Stockham Div.
   e. East Jordan Iron Works, Inc.
   f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
   g. McWane, Inc.; Kennedy Valve Div.

   h. McWane, Inc.; M & H Valve Company Div.
   i. McWane, Inc.; Tyler Pipe Div.; Utilities Div.
   j. Mueller Co.; Water Products Div.
   k. NIBCO INC.
   l. U.S. Pipe and Foundry Company.

2. Nonrising-Stem, Metal-Seated Gate Valves:

   a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.

      1) Standard: AWWA C500.
      2) Minimum Pressure Rating: 200 psig.
      3) End Connections: Mechanical joint.
      4) Interior Coating: Complying with AWWA C550.

3. Nonrising-Stem, Resilient-Seated Gate Valves:

   a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

      1) Standard: AWWA C509.
      2) Minimum Pressure Rating: 200 psig.
      3) End Connections: Mechanical joint.
      4) Interior Coating: Complying with AWWA C550.

4. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:

a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 250 psig.
3) End Connections: Push on or mechanical joint.
4) Interior Coating: Complying with AWWA C550.

2.6 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
b. East Jordan Iron Works, Inc.
c. Flowserve.
d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
e. McWane, Inc.; Kennedy Valve Div.
f. McWane, Inc.; M & H Valve Company Div.
g. Mueller Co.; Water Products Div.
h. U.S. Pipe and Foundry Company.

2. Description: Sleeve and valve compatible with drilling machine.

a. Standard: MSS SP-60.
b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
c. Valve: AWWA, cast-iron, nonrising-stem, metal or resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B, Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.7 CHECK VALVES

A. AWWA Check Valves:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American AVK Co.; Valves & Fittings Div.
b. American Cast Iron Pipe Co.; American Flow Control Div.
c. APCO Williamette; Valve and Primer Corporation.
d. Crane Co.; Crane Valve Group; Crane Valves.

e. Crane Co.; Crane Valve Group; Stockham Div.
f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
g. McWane, Inc.; Kennedy Valve Div.
h. McWane, Inc.; M & H Valve Company Div.
i. Mueller Co.; Water Products Div.
j. NIBCO INC.
k. Watts Water Technologies, Inc.

2. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.

a. Standard: AWWA C508.
b. Pressure Rating: 175 psig.

2.8 DETECTOR CHECK VALVES

A. Detector Check Valves:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ames Fire & Waterworks; a division of Watts Regulator Co.
b. Badger Meter, Inc.
c. FEBCO; SPX Valves & Controls.
d. Globe Fire Sprinkler Corporation.
e. McWane, Inc.; Kennedy Valve Div.
f. Mueller Co.; Hersey Meters.
g. Victaulic Company of America.
h. Viking Corporation.
i. Watts Water Technologies, Inc.

2. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.

a. Standards: UL 312 and FMG approved.
b. Pressure Rating: 175 psig.
c. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

2.9 BUTTERFLY VALVES

A. AWWA Butterfly Valves:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. DeZURIK/Copes-Vulcan; a unit of SPX Corporation.
b. Milliken Valve Company.
c. Mosser Valve; a division of Olson Technologies, Inc.
d. Mueller Co.; Water Products Div.
e. Pratt, Henry Company.

f. Val-Matic Valve & Manufacturing Corp.

2. Description: Rubber seated.

a. Standard: AWWA C504.
b. Body: Cast or ductile iron.
c. Body Type: Wafer or flanged.
d. Pressure Rating: 150 psig.

2.10 WATER METERS

A. Water meters will be furnished by utility company.

B. Manufacturers:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. AMCO Water Metering Systems.
b. Badger Meter, Inc.
c. Carlon Meter.
d. Hays Fluid Controls; a division of ROMAC Industries Inc.
e. McCrometer.
f. Mueller Co.; Hersey Meters.
g. Neptune Technology Group Inc.
h. Sensus Metering Systems.

B. Remote Registration System:

1. Description: Utility company standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.

a. Standard: AWWA C706.
b. Registration: Flow in gallons or cubic feet.

2.11 DETECTOR-TYPE WATER METERS

A. Detector-Type Water Meters:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Badger Meter, Inc.
b. Mueller Co.; Hersey Meters.
c. Neptune Technology Group Inc.
d. Sensus Metering Systems.

B. Description: Main line, proportional meter with second meter on bypass. Register flow in gallons or cubic feet.

1. Standards: AWWA C703, UL listed, and FMG approved.
2. Pressure Rating: 150 psig.
3. Bypass Meter: AWWA C701, turbine or AWWA C702, compound-type, bronze case.

a. Size: At least one-half nominal size of main-line meter.

D. Remote Registration System – direct read:

1. Description: Utility company standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.

a. Standard: AWWA C706.
b. Registration: Flow in gallons or cubic feet.

2.12 PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Cash Acme; a division of The Reliance Worldwide Corporation.
b. Conbraco Industries, Inc.
c. Honeywell Water Controls.
d. Watts Water Technologies, Inc.
e. Zurn Plumbing Products Group; Wilkins Water Control Products Div.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial pressure of 150 psig.
4. Size: As required by local jurisdiction.
5. Body: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2 and NPS 3.
6. Valves for Booster Heater Water Supply: Include integral bypass.
7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

B. Water Control Valves:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. CLA-VAL Automatic Control Valves.
b. Flomatic Corporation.
c. OCV Control Valves.
d. Watts Regulator Co.; Ames Fluid Control Systems.
e. Watts Regulator Co.; Watts ACV Division.
f. Zurn Plumbing Products Group; Wilkins Water Control Products Div.

2. Description: Pilot-operation, diaphragm-type, single-seated main water control valve with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot control valve, restrictor device, specialty fittings, and sensor piping.

a. Pressure Rating: Initial pressure of 150 psig minimum.
b. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.

1) Size: As required by local jurisdiction.
2) Pattern: Angle or Globe-valve design.
3) Trim: Stainless steel.

c. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.13 RELIEF VALVES

A. Air-Release Valves:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crispin-Multiplex Manufacturing Co.
b. GA Industries, Inc.
c. Val-Matic Valve & Manufacturing Corp.

2. Description: Hydromechanical device to automatically release accumulated air.

a. Standard: AWWA C512.
b. Pressure Rating: 300 psig.
c. Body Material: Cast iron.
d. Trim Material: Stainless steel, brass, or bronze.

B. Air/Vacuum Valves:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crispin-Multiplex Manufacturing Co.
b. GA Industries, Inc.
c. Val-Matic Valve & Manufacturing Corp.

2. Description: Direct-acting, float-operated, hydromechanical device with large orifice to automatically release accumulated air or to admit air during filling of piping.

a. Standard: AWWA C512.
b. Pressure Rating: 300 psig.
c. Body Material: Cast iron.
d. Trim Material: Stainless steel, brass, or bronze.

C. Combination Air Valves:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crispin-Multiplex Manufacturing Co.
b. GA Industries, Inc.
c. Val-Matic Valve & Manufacturing Corp.

2. Description: Float-operated, hydromechanical device to automatically release accumulated air or to admit air.

a. Standard: AWWA C512.
b. Pressure Rating: 300 psig.
c. Body Material: Cast iron.
d. Trim Material: Stainless steel, brass, or bronze.

2.14 VACUUM BREAKERS

A. Pressure Vacuum Breaker Assembly:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Ames Fire & Waterworks; a division of Watts Regulator Co.
   b. Conbraco Industries, Inc.
   c. FEBCO; SPX Valves & Controls.
   d. Flomatic Corporation.
   e. Toro Co. (The); Irrigation Division.
   f. Watts Water Technologies, Inc.
   g. Zurn Plumbing Products Group; Wilkins Water Control Products Div.

2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Size: Per local jurisdiction requirements.
6. Accessories: Ball valves on inlet and outlet.

2.15 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Ames Fire & Waterworks; a division of Watts Regulator Co.
   b. Conbraco Industries, Inc.
   c. FEBCO; SPX Valves & Controls.
   d. Flomatic Corporation.
   e. Watts Water Technologies, Inc.
   f. Zurn Plumbing Products Group; Wilkins Water Control Products Div.

2. Standard: AWWA C511.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Size: Per local jurisdiction requirements.
6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
8. Configuration: Designed for application required.
9. Accessories:

   a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
   b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.

B. Double-Check, Backflow-Prevention Assemblies:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Ames Fire & Waterworks; a division of Watts Regulator Co.
   b. Conbraco Industries, Inc.
   c. FEBCO; SPX Valves & Controls.

d. Flomatic Corporation.
e. Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Wilkins Water Control Products Div.

2. Standard: AWWA C510.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Size: As required by local jurisdiction.
6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
8. Configuration: Designed for application required.
9. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

C. Reduced-Pressure-Detector, Fire-Protection Backflow Preventer Assemblies:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ames Fire & Waterworks; a division of Watts Regulator Co.
b. Conbraco Industries, Inc.
c. FEBCO; SPX Valves & Controls.
d. Watts Water Technologies, Inc.
e. Zurn Plumbing Products Group; Wilkins Water Control Products Div.

2. Standards: ASSE 1047 and UL listed or FMG approved.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.
6. End Connections: Flanged.
7. Configuration: Designed application required.
8. Accessories:

a. Valves: UL 262, FMG-approved, OS&Y gate type with flanged ends on inlet and outlet.
b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.
c. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

D. Double-Check, Detector-Assembly Backflow Preventers:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ames Fire & Waterworks; a division of Watts Regulator Co.
b. Conbraco Industries, Inc.
c. FEBCO; SPX Valves & Controls.
d. Watts Water Technologies, Inc.
e. Zurn Plumbing Products Group; Wilkins Water Control Products Div.

2. Standards: ASSE 1048 and UL listed or FMG approved.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.
6. End Connections: Flanged.

7. Configuration: Designed for application required.
8. Accessories:

    a. Valves: UL 262, FMG-approved, OS&Y gate type with flanged ends on inlet and outlet.
    b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

E. Backflow Preventer Test Kits:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Conbraco Industries, Inc.
    b. FEBCO; SPX Valves & Controls.
    c. Flomatic Corporation.
    d. Watts Water Technologies, Inc.
    e. Zurn Plumbing Products Group; Wilkins Water Control Products Div.

2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.16 WATER METER BOXES

A. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping.

1. Option: Base section may be cast-iron, PVC, or other pipe.

2.17 CONCRETE VAULTS

A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C 857 and made according to ASTM C 858.

1. Ladder: ASTM A 36, steel or polyethylene-encased steel steps.
2. Manhole: ASTM A 48 Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.
    a. Dimension: 24-inch minimum diameter, unless otherwise indicated.

3. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron traffic frame and cover.

    a. Dimension: 24-inch minimum diameter, unless otherwise indicated.

4. Drain: ASME A112.6.3, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.18 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. American AVK Co.; Valves & Fittings Div.

b. American Cast Iron Pipe Co.; American Flow Control Div.
c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
d. American Foundry Group, Inc.
e. East Jordan Iron Works, Inc.
f. McWane, Inc.; Clow Valve Co. Div.
g. McWane, Inc.; Kennedy Valve Div.
h. McWane, Inc.; M & H Valve Company Div.
i. Mueller Co.; Water Products Div.
j. Troy Valve; a division of Penn-Troy Manufacturing, Inc.
k. U.S. Pipe and Foundry Company.

2. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.

a. Standard: AWWA C502.
b. Pressure Rating: 250 psig.

B. Wet-Barrel Fire Hydrants:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American AVK Co.; Valves & Fittings Div.
b. Jones, James Company.
c. McWane, Inc.; Clow Valve Co. Div. (Corona).
d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
e. Mueller Co.; Water Products Div.

2. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, NPS 6 threaded or flanged inlet, and base section with NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550.

a. Standard: AWWA C503.
b. Pressure Rating: 150 psig minimum.

2.19 FLUSHING HYDRANTS

A. Post-Type Flushing Hydrants:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. GIL Industries, Inc.
b. Kupferle Foundry Co. (The).
c. Mueller Co.; Water Products Div.

2. Description: Nonfreeze and drainable, of length required for shutoff valve installation below frost line.

a. Pressure Rating: 150 psig minimum.
b. Outlet: One, with horizontal discharge.

c. Hose Thread: NPS 2-1/2, with NFPA 1963 external hose thread for use by local fire department, and with cast-iron cap with brass chain.
d. Barrel: Cast-iron or steel pipe with breakaway feature.
e. Valve: Bronze body with bronze-ball or plunger closure, and automatic draining.
f. Security: Locking device for padlock.
g. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.
h. Inlet: NPS 2 minimum.
i. Operating Wrench: One for each unit.

B. Ground-Type Flushing Hydrants:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Kupferle Foundry Co. (The).
b. Mueller Co.; Water Products Div.

2. Description: Nonfreeze and drainable, of length required for shutoff valve installation below frost line.

a. Pressure Rating: 150 psig minimum.
b. Outlet: One, with vertical or angle discharge.
c. Hose Thread: NPS 2-1/2, with NFPA 1963 external hose thread for use by local fire department, and with cast-iron cap with brass chain.
d. Barrel: Cast-iron or steel pipe.
e. Valve: Bronze body with bronze-ball or plunger closure, and automatic draining.
f. Inlet: NPS 2 minimum.
g. Hydrant Box: Cast iron with cover, for ground mounting.
h. Operating Wrench: One for each unit.

C. Post-Type Sampling Station:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. GIL Industries, Inc.
b. Kupferle Foundry Co. (The).

2. Description: Nonfreeze and drainable, of length required for shutoff valve installation below frost line.

a. Pressure Rating: 100 psig minimum.
b. Sampling Outlet: One unthreaded nozzle with handle.
c. Valve: Bronze body with bronze-ball or plunger closure. Include operating handle.
d. Drain: Tubing with separate manual vacuum pump.
e. Inlet: NPS 3/4 minimum.
f. Housing: Weatherproof material with locking device. Include anchor device.
g. Operating Wrench: One for each unit.

2.20 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:

1. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Elkhart Brass Mfg. Co., Inc.
b. Fire End & Croker Corporation.
c. Guardian Fire Equipment, Inc.
d. Kidde Fire Fighting.
e. Potter Roemer.
f. Reliable Automatic Sprinkler Co., Inc.

2. Description: Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch high brass sleeve; and round escutcheon plate.

a. Standard: UL 405.
b. let Alignment: Inline, horizontal.
c Finish Including Sleeve: Polished bronze.
d Escutcheon Plate Marking: Per local jurisdiction requirements.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 31 for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping NPS 3/4 to NPS 3 shall be the following:

1. Soft copper tube, ASTM B 88, Type K or ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. PVC, Schedule 40 pipe; PVC, Schedule 40 or 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.

F. Underground water-service piping NPS 4 to NPS 8 shall be the following:

1. Soft copper tube, ASTM B 88, Type K or ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed or mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
3. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.
4. NPS 4 and NPS 6: NPS 6 PVC, AWWA Class 200 pipe; PVC, AWWA Class 200 fittings; and gasketed joints.
5. NPS 8: PVC, AWWA Class 200 pipe; PVC, AWWA Class 200 fabricated fittings; and gasketed joints.

G. Water Meter Box Water-Service Piping NPS 3/4 to NPS 2 shall be same as underground water-service piping.

H. Aboveground and Vault Water-Service Piping NPS 3/4 to NPS 3 shall be the following:

1. Hard copper tube, ASTM B 88, Type K or ASTM B 88, Type L joints.
2. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.

I. Aboveground and vault water-service piping NPS 4 to NPS 8 shall be the following:

1. Hard copper tube, ASTM B 88, Type K or ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.
3. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.

J. Underground Fire-Service-Main Piping NPS 4 to NPS 12 shall be the following:

1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed or mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
2. PVC, AWWA Class 200 pipe listed for fire-protection service; PVC Class 200 fabricated fittings; and gasketed joints.

K. Aboveground and Vault Fire-Service-Main Piping NPS 4 to NPS 12 shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.

L. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 12 shall be the following:

1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed or mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
2. PVC, AWWA Class 200 pipe listed for fire-protection service; PVC fabricated or molded fittings of same class as pipe; and gasketed joints.

M. Aboveground and Vault Combined Water Service and Fire-Service-Main Piping NPS 6 to NPS 12 shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, metal, h-pressure, resilient-seated gate valves with valve box.
2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
3. Use the following for valves in vaults and aboveground:

    a. Gate Valves, NPS 2 and Smaller: Bronze, nonrising or rising stem.
    b. Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, metal seated or AWWA, cast iron, OS&Y rising stem, resilient seated.
    c. Check Valves: AWWA C508, swing type.

4. Pressure-Reducing Valves: Use for water-service piping in vaults and aboveground to control water pressure.
5. Relief Valves: Use for water-service piping in vaults and aboveground.

    a. Air-Release Valves: To release accumulated air.
    b. Air/Vacuum Valves: To release or admit large volume of air during filling of piping.
    c. Combination Air Valves: To release or admit air.

6. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Division 22 for piping-system common requirements.

3.5 PIPING INSTALLATION

A. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

B. Make connections larger than NPS 2 with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

C. Make connections NPS 2 and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

D. Comply with NFPA 24 for fire-service-main piping materials and installation.

1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
2. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

F. Install PE pipe according to ASTM D 2774 and ASTM F 645.

G. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

H. Install fiberglass AWWA pipe according to AWWA M45.

I. Bury piping with depth of cover over top per local jurisdiction requirements.

J. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

K. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

L. Sleeves are specified in Division 22 .

M. Mechanical sleeve seals are specified in Division 22.

N. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

O. See Division 21 for fire-suppression-water piping inside the building.

P. See Division 22 for potable-water piping inside the building.

3.6 JOINT CONSTRUCTION

A. See Division 22 for basic piping joint construction.

B. Make pipe joints according to the following:

1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
3. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
4. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
5. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
6. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 22 for joining piping of dissimilar metals.

3.7 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.
6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.
4. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.8 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.

E. MSS Valves: Install as component of connected piping system.

F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

G. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves.

H. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

3.9 DETECTOR-CHECK VALVE INSTALLATION

A. Install in vault or aboveground.

B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

C. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

3.10 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

B. Water Meters: Install displacement or turbine-type water meters, NPS 2 and smaller, in meter boxes with shutoff valves on water meter inlets. Include valves on water meter outlets and valved bypass around meters.

C. Water Meters: Install compound or turbine-type water meters, NPS 3 and larger, in meter vaults. Include shutoff valves on water meter inlets and outlets and valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

D. Water Meters: Install detector-type water meters in meter vault according to AWWA M6. Include shutoff valves on water meter inlets and outlets and full-size valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

3.11 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.12 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.13 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.

3.14 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults according to ASTM C 891.

3.15 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with re-strained joints or thrust blocks, and support in upright position.

B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.

C. AWWA Fire Hydrants: Comply with AWWA M17.

D. UL/FMG Fire Hydrants: Comply with NFPA 24.

3.16 FLUSHING HYDRANT INSTALLATION

A. Install post-type flushing hydrants with valve below frost line and provide for drainage. Support in upright position. Include separate gate valve or curb valve and restrained joints in supply piping.

B. Install ground-type flushing hydrants with valve below frost line and provide for drainage. Install hydrant box flush with grade. Include separate gate valve or curb valve and restrained joints in supply piping.

C. Install sampling stations with valve below frost line and provide for drainage. Attach weather-resistant housing and support in upright position. Include separate curb valve in supply piping.

3.17 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire department connection to mains.

3.18 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. See Division 22 for piping connections to valves and equipment.

C. Coordinate and/or direct water-distribution piping to utility water main. Use tapping sleeve and tapping valve or service clamp and corporation valve as required by local jurisdiction.

D. Connect water-distribution piping to interior domestic water and fire-suppression piping.

E. Connect waste piping from concrete vault drains to sanitary sewerage system or storm drainage system as required by local jurisdiction.

F. Ground equipment according to Division 26.

G. Connect wiring according to Division 26.

3.19 THRUST BLOCKING:

A. Restrain pipe by thrust blocking as shown on the plans, in the event of the following piping conditions:

1. A change of direction with the use of a tee or bend.
2. Reduction in the size of the line by use of a reducer.
3. Termination of line (dead end).

3.20 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.21 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31.

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Division 22 for identifying devices.

3.22 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.

2. Use purging and disinfecting procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

C. Repeat the procedure.

END OF SECTION

SECTION 33 3000

SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01.

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Nonpressure and pressure couplings.
3. Cleanouts.
4. Manholes.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Pipe.
2. Cleanouts.

B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers. Demonstrate compliance with local jurisdiction requirements.

C. Coordinate Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

D. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

E. Field quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

A. Pipe: ASTM A 746, for push-on joints.

B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153, ductile iron, for push-on joints.

D. Gaskets: AWWA C111, rubber.

2.2 DUCTILE-IRON, PRESSURE PIPE AND FITTINGS

A. Push-on-Joint Piping:

1. Pipe: AWWA C151.
2. Standard Fittings: AWWA C110, ductile or gray iron.
3. Compact Fittings: AWWA C153.
4. Gaskets: AWWA C111, rubber, of shape matching pipe and fittings.

B. Mechanical-Joint Piping:

1. Pipe: AWWA C151, with bolt holes in bell.
2. Standard Fittings: AWWA C110, ductile or gray iron, with bolt holes in bell.
3. Compact Fittings: AWWA C153, with bolt holes in bells.
4. Glands: Cast or ductile iron; with bolt holes and high-strength, cast-iron or high-strength, low-alloy steel bolts and nuts.
5. Gaskets: AWWA C111, rubber, of shape matching pipe, fittings, and glands.

2.3 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

B. PVC Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F 679, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

C. PVC Pressure Piping:

1. Pipe: AWWA C900, Class 200 PVC pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: AWWA C900, Class 200 PVC pipe with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.4 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

1. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Dallas Specialty & Mfg. Co.
b. Fernco Inc.
c. Logan Clay Pipe.
d. Mission Rubber Company; a division of MCP Industries, Inc.
e. NDS.
f. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.

2. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:

1. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Cascade Waterworks Mfg.
b. Dallas Specialty & Mfg. Co.
c. Mission Rubber Company; a division of MCP Industries, Inc.

2. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:

1. Manufacturers: available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Fernco Inc.
b. Logan Clay Pipe.
c. Mission Rubber Company; a division of MCP Industries, Inc.

2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

F. Nonpressure-Type, Rigid Couplings:

1. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. ANACO-Husky.

2. Description: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling, molded from ASTM C 1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.5 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Josam Company.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.
   d. Tyler Pipe.
   e. Watts Water Technologies, Inc.
   f. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Top-Loading Classification(s): Light Duty, Medium Duty, Heavy Duty, and Extra-Heavy Duty.
4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts:

1. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Canplas LLC.
   b. IPS Corporation.
   c. NDS.
   d. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
   e. Sioux Chief Manufacturing Company, Inc.
   f. Zurn Light Commercial Products Operation; Zurn Plumbing Products Group.

2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.6 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps or FRP ladder per local jurisdiction; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals.
10. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:

1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
5. Steps: Individual FRP steps or FRP ladder per local jurisdiction; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12 to 16 inch intervals.
6. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
7. Grade Rings: Reinforced-concrete rings, 6 to 9 inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

C. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7 to 9 inch riser, with 4-inch-minimum-width flange and 26 inch diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER" per local jurisdiction requirements.
2. Material: ASTM A 536, Grade 60-40-18 ductile or ASTM A 48, Class 35 gray iron.

D. Manhole-Cover Inserts:

1. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. FRW Industries; a Syneco Systems, Inc. company.
   b. Knutson Enterprises.
   c. L. F. Manufacturing, Inc.
   d. Parson Environmental Products, Inc.

2. Description; Manufactured, plastic form, of size to fit between manhole frame and cover and designed to prevent stormwater inflow. Include handle for removal and gasket for gastight sealing.
3. Type: Solid or vented per local jurisdiction requirements.

2.7 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R , and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

   a. Invert Slope: Per local jurisdiction requirements.

2. Benches: Concrete, sloped to drain into channel.

   a. Slope: Per local jurisdiction requirements.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31.

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout should take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with minimum cover per local jurisdiction requirements.
4. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
5. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
6. Install ductile-iron, gravity sewer piping according to ASTM A 746.
7. Install ABS sewer piping according to ASTM D 2321 and ASTM F 1668.
8. Install PVC cellular-core sewer piping according to ASTM D 2321 and ASTM F 1668.
9. Install PVC corrugated sewer piping according to ASTM D 2321 and ASTM F 1668.
10. Install PVC profile sewer piping according to ASTM D 2321 and ASTM F 1668.
11. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.
12. Install PVC gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
13. Install fiberglass sewer piping according to ASTM D 3839 and ASTM F 1668.

14. Install nonreinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
15. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

G. Install force-main, pressure piping according to the following:

1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
2. Install piping with minimum cover per local jurisdiction requirements.
3. Install ductile-iron pressure piping according to AWWA C600 or AWWA M41.
4. Install ductile-iron special fittings according to AWWA C600.
5. Install PVC pressure piping according to AWWA M23 or to ASTM D 2774 and ASTM F 1668.
6. Install PVC water-service piping according to ASTM D 2774 and ASTM F 1668.

H. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
4. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.
5. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.
6. Join PVC cellular-core sewer piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
7. Join PVC corrugated sewer piping according to ASTM D 2321.
8. Join PVC profile sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
9. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
10. Join PVC gravity sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
11. Join fiberglass sewer piping according to ASTM D 4161 for elastomeric-seal joints.
12. Join nonreinforced-concrete sewer piping according to ASTM C 14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
13. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
14. Join dissimilar pipe materials with nonpressure-type, flexible or rigid couplings.

B. Join force-main, pressure piping according to the following:

1. Join ductile-iron pressure piping according to AWWA C600 or AWWA M41 for push-on joints.

2. Join ductile-iron special fittings according to AWWA C600 or AWWA M41 for push-on joints.
3. Join PVC pressure piping according to AWWA M23 for gasketed joints.
4. Join PVC water-service piping according to ASTM D 2855.
5. Join dissimilar pipe materials with pressure-type couplings.

C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

a. Unshielded or Shielded flexible or rigid couplings for pipes of same or slightly different OD per local jurisdiction requirements.
b. Unshielded, increaser/reducer-pattern, flexible or rigidcouplings for pipes with different OD per local jurisdiction requirements.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure pipe couplings for force-main joints.

3.4 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Install FRP manholes according to manufacturer's written instructions.

D. Form continuous concrete channels and benches between inlets and outlet.

E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

F. Install manhole-cover inserts in frame and immediately below cover.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.6 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves in piping manholes or pits.

B. Install combination horizontal and manual gate valves in piping and in manholes.

C. Install terminal-type backwater valves on end of piping and in manholes. Secure units to sidewalls.

3.7 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 inches deep unless otherwise shown. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.8 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 22.

B. Connect force-main piping to building's sanitary force mains specified in Division 22. Terminate piping where indicated.

C. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

D. Connect to grease, oil, and sand interceptors specified in Division 22.

3.9 CLOSING ABANDONED SANITARY SEWER SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.

2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:

1. Remove manhole and close open ends of remaining piping.
2. Remove top of manhole down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Division 31.

3.10 IDENTIFICATION

A. Materials and their installation are specified in Division 31. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Schedule tests and inspections with at least 24 hours' advance notice.
3. Submit separate report for each test.
4. Hydrostatic Tests: Test sanitary sewerage according to the following:

a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
b. Close openings in system and fill with water.

c. Purge air and refill with water.
d. Disconnect water supply.
e. Test and inspect joints for leaks.

5. Air Tests: Test sanitary sewerage according to UNI-B-6, and the following:

a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
b. Option: Test concrete gravity sewer piping according to ASTM C 924.

6. Force Main: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig.

a. Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

7. Manholes: Perform hydraulic test according to ASTM C 969.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION

SECTION 33 4100

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Nonpressure transition couplings.
4. Expansion joints and deflection fittings.
5. Backwater valves.
6. Cleanouts.
7. Drains.
8. Encasement for piping.
9. Manholes..
10. Catch basins.
11. Stormwater inlets.
12. Stormwater detention structures.
13. Pipe outlets.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Catch basins and stormwater inlets: Include plans, elevations, sections, details, frames, covers, and grates.
3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames, covers, design calculations, and concrete design-mix reports.

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

D. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

E. Field quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON, CULVERT PIPE AND FITTINGS

A. Pipe: ASTM A 716, for push-on joints.

B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153, for push-on joints.

D. Gaskets: AWWA C111, rubber.

2.2 ABS PIPE AND FITTINGS

A. ABS Sewer Pipe and Fittings: ASTM D 2751, with bell-and-spigot ends for gasketed joints.

1. NPS 3 to NPS 6 (DN 80 to DN 150): SDR 35.
2. NPS 8 to NPS 12 (DN 200 to DN 300): SDR 42.

B. Gaskets: ASTM F 477, elastomeric seals.

2.3 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 3 to NPS 10 (DN 80 to DN 250): AASHTO M 252M, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
2. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.

2.4 PVC PIPE AND FITTINGS

A. PVC Cellular-Core Piping: PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.

1. Fittings: ASTM D 3034, SDR 35, PVC socket-type fittings.

2.5 CONCRETE PIPE AND FITTINGS

A Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76.

1. Bell-and-spigot or tongue-and-groove ends and gasketed joints with ASTM C 443, rubber gaskets]

2.6 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Concrete Pipes: ASTM C 443, rubber.
2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
3. For Fiberglass Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
4. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
5. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Dallas Specialty & Mfg. Co.
b. Fernco Inc.
c. Logan Clay Pipe.
d. Mission Rubber Company; a division of MCP Industries, Inc.
e. NDS Inc.
f. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.

2. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Cascade Waterworks Mfg.
b. Dallas Specialty & Mfg. Co.
c. Mission Rubber Company; a division of MCP Industries, Inc.

2. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Fernco Inc.
   b. Logan Clay Pipe.
   c. Mission Rubber Company; a division of MCP Industries, Inc.

2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.7 EXPANSION JOINTS AND DEFLECTION FITTINGS

A. Ductile-Iron Flexible Expansion Joints:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. EBAA Iron Sales, Inc.
   b. Romac Industries, Inc.
   c. Star Pipe Products.

2. Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated.

B. Ductile-Iron Expansion Joints:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Dresser, Inc.
   b. EBAA Iron Sales, Inc.
   c. JCM Industries, Inc.
   d. Smith-Blair, Inc.; a Sensus company.

2. Description: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron or steel with protective coating, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for expansion indicated.

C. Ductile-Iron Deflection Fittings:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. EBAA Iron Sales, Inc.

2. Description: Compound-coupling fitting, with ball joint, flexing section, gaskets, and restrained-joint ends, complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for up to 15 degrees of deflection.

2.8 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Josam Company.
   b. MIFAB, Inc.
   e. Smith, Jay R. Mfg. Co.
   f. Tyler Pipe.
   g. Watts Water Technologies, Inc.
   h. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Retain one or more options in first subparagraph below. If more than one top-loading classification is required, show location of each on Drawings.
4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.9 DRAINS

A. Cast-Iron Area Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Josam Company.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.
   d. Tyler Pipe.
   e. Watts Water Technologies, Inc.
   f. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

2. Description: ASME A112.6.3 gray-iron round body with anchor flange and round grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.

B. Cast-Iron Trench Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Josam Company.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.
   d. Tyler Pipe.
   e. Watts Water Technologies, Inc.
   f. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

2. Description: ASME A112.6.3, 6-inch-wide top surface, rectangular body with anchor flange or other anchoring device, and rectangular grate. Include units of total length indicated and quantity of bottom outlets with inside calk or spigot connections, of sizes indicated.

2.10 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:

1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
5. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
6. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.

7. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.

C. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile Iron unless otherwise indicated.

2.11 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

a. Invert Slope: 1 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.

a. Slope: 4 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.12 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS

A. General Requirements for Polymer-Concrete, Channel Drainage Systems: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include quantity of units required to form total lengths indicated.

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. ABT, Inc.
2. ACO USA.
3. Innovative Plastic, Inc.; a subsidiary of T-H Marine Supplies, Inc.
4. Mea-Josam Div.; Josam Company.
5. Poly-Cast.

C. Sloped-Invert, Polymer-Concrete Systems:

1. Channel Sections:

   a. Interlocking-joint, precast, modular units with end caps.
   b. 4-inch (102-mm) inside width and deep, rounded bottom, with built-in invert slope of 0.6 percent and with outlets in quantities, sizes, and locations indicated.
   c. Extension sections necessary for required depth.
   d. Frame: Include gray-iron or steel frame for grate.

2. Grates:

   a. Manufacturer's designation "Heavy Duty," with slots or perforations that fit recesses in channels.
   b. Material: Fiberglass, Galvanized steel, Gray iron, Stainless steel.

3. Covers: Solid gray iron if indicated.
4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

D. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.

E. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.13 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
5. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and grate.
8. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches
9. Pipe Connectors: ASTM C 923 resilient, of size required, for each pipe connecting to base section.

B. Designed Precast Concrete Catch Basins: ASTM C 913, precast, reinforced concrete; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.

1. Joint Sealants: ASTM C 990, bitumen or butyl rubber.
2. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
3. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and grate.
4. Steps: Individual FRP steps or FRP ladder wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches
5. Pipe Connectors: ASTM C 923 resilient, of size required, for each pipe connecting to base section.

C. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.

1. Size: 24 by 24 inches minimum unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

2.14 STORMWATER INLETS

A. Curb Inlets: Made with vertical curb opening of materials and dimensions according to utility standards.

B. Gutter Inlets: Made with horizontal gutter opening of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

C. Combination Inlets: Made with vertical curb and horizontal gutter openings of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

D. Frames and Grates: Heavy duty according to utility standards.

2.15 STORMWATER DETENTION STRUCTURES

A. Cast-in-Place Concrete, Stormwater Detention Structures: Constructed of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.

1. Ballast: Increase thickness of concrete as required to prevent flotation.
2. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and cover.
3. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of structure to finished grade is less than 60 inches.

B. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

2.16 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.
B. Riprap Basins: Broken, irregularly sized and shaped, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."

C. Filter Stone: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.

D. Energy Dissipaters: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
3. Install piping with 24-inch minimum cover.
4. Install ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
5. Install corrugated steel piping according to ASTM A 798/A 798M.
6. Install PVC cellular-core piping according to ASTM D 2321 and ASTM F 1668.
7. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join ductile-iron culvert piping according to AWWA C600 for push-on joints.
2. Join ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
3. Join corrugated steel sewer piping according to ASTM A 798/A 798M.
4. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
5. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
6. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
7. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves in piping where indicated.

B. Install combination horizontal and manual gate-valve type in piping and in manholes where indicated.

C. Install terminal-type backwater valves on end of piping and in manholes where indicated.

3.5 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.6 DRAIN INSTALLATION

A. Embed drains in 4-inch minimum concrete around bottom and sides.

B. Fasten grates to drains if indicated.

C. Set drain frames and covers with tops flush with pavement surface.

D. Assemble trench sections with flanged joints.

E. Embed trench sections in 4-inch minimum concrete around bottom and sides.

3.7 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

3.8 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.9 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, anchored with concrete, where indicated.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipaters at outlets, as indicated.

3.10 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.11 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches (150 mm) of concrete for minimum

length of 12 inches to provide additional support of collar from connection to undisturbed ground.

a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

C. Connect to sediment interceptors specified in Division 22 Section "Sanitary Waste Interceptors."

D. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

a. Shielded flexible couplings for same or minor difference OD pipes.
b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure-type pipe couplings for force-main joints.

3.12 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch- thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.
2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Division 31 Section "Earth Moving."

3.13 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape over ferrous piping.

2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.14 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of local jurisdiction.
3. Schedule tests and inspections with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of local jurisdiction, UNI-B-6, and the following:

   a. Exception: Piping with soiltight joints.
   b. Option: Test plastic piping according to ASTM F 1417.
   c. Option: Test concrete piping according to ASTM C 924.

6. Force-Main Storm Drainage Piping: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig.

   a. Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
   b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.15 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 334100

SECTION 33 4123

STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Roof drains.
2. Miscellaneous storm drainage piping specialties.
3. Cleanouts.
5. Trench drains.
7. Flashing materials.

1.3 SUBMITTALS

A. Product Data: As requested, for each type of product indicated.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PLASTIC ROOF DRAINS

A. Plastic Roof Drains:

1. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Canplas LLC.
   b. LSP Products Group, Inc.
   c. Marathon Roofing Products.
   d. OMG, Inc.
   e. Plastic Oddities; a division of Diverse Corporate Technologies.
   f. Portals Plus; Commercial Products Group of Hart & Cooley, Inc.
   g. Sioux Chief Manufacturing Company, Inc.
   h. Town & Country Plastics, Inc.
   i. Zurn Plumbing Products Group; Light Commercial Products Operation.

2. Standard: ASME A112.6.4, for plastic roof drains.
3. Body Material: PVC.
4. Diameter: As indicated.

2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Downspout Boots:

1. Description: Manufactured, ASTM A 48, gray-iron casting, with strap or ears for attaching to building; NPS 4 outlet; and shop-applied bituminous coating.
2. Size: Inlet size to match downspout and NPS 4 outlet.

2.3 TRENCH DRAINS

A. Trench Drains:

1. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Josam Company.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.
   d. Tyler Pipe.
   e. Watts Water Technologies, Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3, for trench drains.
3. Body Material: Cast iron.
4. Flange: Anchor.
5. Clamping Device: Required.
6. Outlet: As indicated.
7. Grate Material: Ductile iron or gray iron.
8. Grate Finish: Not required.
9. Dimensions of Frame and Grate: As indicated.
10. Top-Loading Classification: Heavy Duty.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drain extensions to connect the vertical building downspout to the site drainage system via downspout boots.

B. Install downspout boots at grade with top 6 inches above grade. Secure to building wall per manufacturer's instructions.

C. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface unless otherwise indicated.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Division 22. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 33 4600

SUBDRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, apply to this Section.

1.2 SUMMARY

A. This Section includes subdrainage systems for the following:

1. Foundations.
2. Underslab areas.
3. Plaza decks.
4. Retaining walls.
5. Landscaped areas.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. HDPE: High-density polyethylene plastic.

C. PE: Polyethylene plastic.

D. PP: Polypropylene plastic.

E. PS: Polystyrene plastic.

F. PVC: Polyvinyl chloride plastic.

G. Subdrainage: Drainage system that collects and removes subsurface or seepage water.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Perforated-wall pipe and fittings.
2. Solid-wall pipe and fittings.
3. Drainage conduits.
4. Drainage panels.
5. Geotextile filter fabrics.

B. Approval of waterproofing manufacturer's service agent for use of drainage panels against and for waterproofing membrane protection.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to the "Piping Applications" Article in Part 3 for applications of pipe, tube, fitting, and joining materials.

2.3 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:

1. NPS 6 and Smaller: ASTM F 405, Type CP; corrugated, for coupled joints.
2. NPS 8 and Larger: ASTM F 667; Type CP; corrugated; for coupled joints.
3. Couplings: Manufacturer's standard, band type.

B. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

C. Perforated Concrete Pipe and Fittings: ASTM C 444, Type 1, and applicable requirements in ASTM C 14, Class 2, socket-and-spigot ends for gasketed joints.

1. Gaskets: ASTM C 443, rubber.

2.4 SOLID-WALL PIPES AND FITTINGS

A. ABS Sewer Pipe and Fittings: ASTM D 2751.

1. Solvent Cement: ASTM D 2235.
2. Gaskets: ASTM F 477, elastomeric seal.

B. Cast-Iron Soil Pipe and Fittings: ASTM A 74, Service and Extra-Heavy classes, hub-and-spigot ends, gray, for gasketed joints.

1. Gaskets: ASTM C 564, rubber, of thickness matching class of pipe.

C. PE Drainage Tubing and Fittings: AASHTO M 252, Type S, corrugated, with smooth waterway, for coupled joints.

1. Couplings: AASHTO M 252, corrugated, band type, matching tubing and fittings.

D. PE Pipe and Fittings: AASHTO M 294, Type S, corrugated, with smooth waterway, for coupled joints.

1. Couplings: AASHTO M 294, corrugated, band type, matching tubing and fittings.

E. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.

1. Gaskets: ASTM F 477, elastomeric seal.

2.5 SPECIAL PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant metal tension band and tightening mechanism on each end.

1. Sleeve Materials:

a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2. Unshielded Flexible Couplings: Elastomeric sleeve with corrosion-resistant metal tension band and tightening mechanism on each end.
3. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant metal tension band and tightening mechanism on each end.

2.6 CLEANOUTS

A. Cast-Iron Cleanouts: ASME A112.36.2M; with round-flanged, cast-iron housing; and secured, scoriated, Medium-Duty Loading class, cast-iron cover. Include cast-iron ferrule and countersunk, brass cleanout plug.

B. Copper-Alloy Cleanouts: ASME A112.36.2M; with round-flanged, cast-iron housing with clamping device; and scoriated, Light or Medium-Duty Loading class, copper-alloy cover. Include countersunk, brass cleanout plug.

C. PVC Cleanouts: ASTM D 3034, PVC cleanout threaded plug and threaded pipe hub.

2.7 DRAINAGE CONDUITS

A. Molded-Sheet Drainage Conduits: Prefabricated geocomposite with cuspated, molded-plastic drainage core wrapped in geotextile filter fabric.
1. Manufacturers:

a. American Wick Drain Corporation.
b. JDR Enterprises, Inc.
c. TC Mirafi.

2. Nominal Size: 12 inches high by approximately 1 inch thick.

a. Minimum In-Plane Flow: 30 gpm at hydraulic gradient of 1.0 when tested according to ASTM D 4716.

3. Nominal Size: 18 inches high by approximately 1 inch thick.

a. Minimum In-Plane Flow: 45 gpm at hydraulic gradient of 1.0 when tested according to ASTM D 4716.

4. Filter Fabric: PP geotextile.
5. Fittings: HDPE with combination NPS 4 and NPS 6 outlet connection.

B. Multipipe Drainage Conduits: Prefabricated geocomposite with interconnected, corrugated, perforated-pipe core molded from HDPE complying with ASTM D 1248 and wrapped in geotextile filter fabric.

1. Manufacturers:

   a. Varicore Technologies, Inc.

2. Nominal Size: 6 inches high by approximately 1-1/4 inches thick.

   a. Minimum In-Plane Flow: 15 gpm at hydraulic gradient of 1.0 when tested according to ASTM D 4716.

3. Nominal Size: 12 inches high by approximately 1-1/4 inches thick.

   a. Minimum In-Plane Flow: 30 gpm at hydraulic gradient of 1.0 when tested according to ASTM D 4716.

4. Nominal Size: 18 inches high by approximately 1-1/4 inches thick.

   a. Minimum In-Plane Flow: 45 gpm at hydraulic gradient of 1.0 when tested according to ASTM D 4716.

5. Filter Fabric: Nonwoven, needle-punched geotextile.
6. Fittings: HDPE with combination NPS 4 and NPS 6 outlet connection.
7. Couplings: HDPE.

C. Single-Pipe Drainage Conduits: Prefabricated geocomposite with perforated corrugated core molded from HDPE complying with ASTM D 3350 and wrapped in geotextile filter fabric.

1. Manufacturers:

   a. , Advanced Drainage Systems.

2. Nominal Size: 12 inches high by approximately 1 inch thick.

   a. Minimum In-Plane Flow: 30 gpm at hydraulic gradient of when tested according to ASTM D 4716.

3. Nominal Size: 18 inches high by approximately 1 inch thick.

   a. Minimum In-Plane Flow: 45 gpm at hydraulic gradient of 1.0 when tested according to ASTM D 4716.

4. Filter Fabric: Nonwoven, PP geotextile.
5. Fittings: HDPE with combination NPS 4 and NPS 6 outlet connection.
6. Couplings: Corrugated HDPE band.

D. Mesh Fabric Drainage Conduits: Prefabricated geocomposite with plastic-filament drainage core wrapped in geotextile filter fabric. Include fittings for bends and connection to drainage piping.

1. Manufacturers:

a. Colbond Geosynthetics.

2. Nominal Size: 6 inches high by approximately 0.9 inch thick.

a. Minimum In-Plane Flow: 2.4 gpm at hydraulic gradient of 1.0 when tested according to ASTM D 4716.

3. Filter Fabric: Nonwoven geotextile made of PP or polyester fibers or combination of both. Flow rates range from 120 to 200 gpm/sq. ft. when tested according to ASTM D 4491.

E. Ring Fabric Drainage Conduits: Drainage conduit with HDPE-rings-in-grid-pattern drainage core, for field-applied geotextile filter fabric. Include fittings for bends and connection to drainage piping.

1. Manufacturers:

a. Invisible Structures, Inc.

2. Nominal Size: 0.5 m high by 1 inch thick.

a. Minimum In-Plane Flow: 82 gpm at hydraulic gradient of 1.0 when tested according to ASTM D 4716.

3. Nominal Size: 1 m high by 1 inch thick.
a. Minimum In-Plane Flow: 164 gpm at hydraulic gradient of 1.0 when tested according to ASTM D 4716.

4. Filter Fabric: Specified in Part 2 "Geotextile Filter Fabrics" Article.

[2.8 DRAINAGE PANELS]

A. Molded-Sheet Drainage Panels: Prefabricated geocomposite, 36 to 60 inches wide with drainage core faced with geotextile filter fabric.

1. Manufacturers:

a. American Wick Drain Corporation.
b. Cosella-Dorken.
c. Eljen Corp.
d. Greenstreak, Inc.
e. JDR Enterprises, Inc.
f. LINQ Industrial Fabrics, Inc.
g. Midwest Diversified Technologies Incorporated.
h. TC Mirafi.

2. Drainage Core: Three-dimensional, nonbiodegradable, molded PP or PS.

    a. Minimum Compressive Strength: **[10,000 lbf/sq. ft.] [15,000 lbf/sq. ft.] [18,000 lbf/sq. ft.] [21,000 lbf/sq. ft.] <Insert value>** when tested according to ASTM D 1621.
    b. Minimum In-Plane Flow Rate: **[2.8 gpm/ft.] [7 gpm/ft.] [15 gpm/ft.] <Insert value>** of unit width at hydraulic gradient of 1.0 and compressive stress of 25 psig when tested according to ASTM D 4716.

3. Filter Fabric: Nonwoven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following properties determined according to AASHTO M 288:

    a. Survivability: Class 3.
    b. Apparent Opening Size: No. 70 sieve, maximum.
    c. Permittivity: 0.5 per second, minimum.

4. Filter Fabric: Woven geotextile fabric, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation less than 50 percent; complying with the following properties determined according to AASHTO M 288:

    a. Survivability: Class 3.
    b. Apparent Opening Size: No. 70 sieve, maximum.
    c. Permittivity: 0.5 per second, minimum.

5. Film Backing: Polymeric film bonded to drainage core surface.

B. Mesh Fabric Drainage Panels: Prefabricated geocomposite with drainage core faced with geotextile filter fabric.

1. Manufacturers:

    a. Colbond Geosynthetics.

2. Drainage Core: Open-construction, resilient, approximately 0.4-inch-thick, plastic-filament mesh.

    a. Minimum In-Plane Flow Rate: 2.4 gpm/ft. of unit width at hydraulic gradient of 1.0 and normal pressure of 25 psig when tested according to ASTM D 4716.

3. Filter Fabric: Nonwoven geotextile of PP or polyester fibers or combination of both. Flow rates range from 120 to 200 gpm/sq. ft. when tested according to ASTM D 4491.

C. Net Fabric Drainage Panels: Prefabricated geocomposite with drainage core faced with geotextile filter fabric.

1. Manufacturers:

    a. GSE Lining Technology, Inc.
    b. JDR Enterprises, Inc.
    c. Strata Systems, Inc.

2. Drainage Core: 3-dimensional, PE nonwoven-strand geonet, approximately 0.25-inch-thick.

a. Minimum In-Plane Flow Rate: 5 gpm/ft. of unit width at hydraulic gradient of 1.0 and normal pressure of 25 psig when tested according to ASTM D 4716.

3. Filter Fabric: Nonwoven geotextile of PP or polyester fibers or combination of both. Flow rates range from 120 to 200 gpm/sq. ft. when tested according to ASTM D 4491.

D. Ring Fabric Drainage Panels: Drainage-core panel for field application of geotextile filter fabric.

1. Manufacturers:

a. Invisible Structures, Inc.

2. Drainage Core: 3-dimensional, HDPE rings in grid pattern, approximately 0.1 inch thick.

a. Minimum In-Plane Flow Rate: 50 gpm/ft. of unit width at hydraulic gradient of 1.0 and normal pressure of 25 psig when tested according to ASTM D 4716.

E. Fabric-Covered Insulated Drainage Panels: Extruded PS board insulation complying with ASTM C 578; fabricated with shiplap or tongue-and-groove edges and with one side having grooved drainage channels; unfaced or faced with geotextile filter fabric.

1. Manufacturers:

a. Dow Chemical Company (The).
b. Owens Corning.
c. T. Clear Corporation.

2. Type IV, 1.6-lb/cu. ft. minimum density and 25-psig minimum compressive strength.
3. Type VI, 1.8-lb/cu. ft. minimum density and 40-psig minimum compressive strength.
4. Minimum In-Plane Flow Rate: 9 gpm/ft. of unit width when tested according to ASTM D 4716.
5. Filter Fabric: Nonwoven geotextile of PP or polyester fibers or combination of both. Flow rates range from 120 to 200 gpm/sq. ft. when tested according to ASTM D 4491.

F. Noncovered Insulated Drainage Panels: Extruded PS board insulation complying with ASTM C 578; fabricated with rabbeted edges and with one side having ribbed drainage channels.

1. Manufacturers:

a. Dow Chemical Company (The).
b. Owens Corning.

2. Type VI, 1.8-lb/cu. ft. minimum density and 40-psig minimum compressive strength.
3. Type VII, 2.2-lb/cu. ft. minimum density and 60-psig minimum compressive strength.
4. Minimum In-Plane Flow Rate: 9 gpm/ft. of unit width when tested according to ASTM D 4716.

G. Expanded PS Insulated Drainage Panels: PS bead board insulation; panels are 4 inches thick by 48 inches wide and faced with geotextile filter fabric.

1. Manufacturers:

a. GeoTech Systems Corporation.

2. Density: 2 lb/cu. ft.
3. Compressive Strength: 800 lbf/sq. ft.
4. Minimum In-Plane Flow Rate: 3 gpm/ft. of unit width when tested according to ASTM D 4716.
5. Filter Fabric: Nonwoven geotextile of PP or polyester fibers or combination of both. Flow rates range from 120 to 200 gpm/sq. ft. when tested according to ASTM D 4491.

2.9 SOIL MATERIALS

A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Division 31 Section "Earth Moving."

2.10 ROOFING FELTS

A. ASTM D 226, Type I, asphalt-saturated roofing felt.

2.11 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.

1. Structure Type: Nonwoven, needle-punched continuous filament or woven, monofilament or multifilament.
2. Style(s): Flat and sock.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31.

3.3 PIPING APPLICATIONS

A. Underground Subdrainage Piping:

1. Perforated PE pipe and fittings, couplings, and coupled joints.
2. Perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.

B. Underslab Subdrainage Piping:

1. Perforated PE pipe and fittings, couplings, and coupled joints.
2. Perforated PVC sewer pipe and fittings and loose, bell-and-spigot joints.

C. Header Piping:

1. Cast-iron soil pipe and fittings, Extra-Heavy class; gaskets; and gasketed joints.
2. PE drainage tubing and fittings, couplings, and coupled joints.
3. PVC sewer pipe and fittings, couplings, and coupled joints.

3.4 CLEANOUT APPLICATIONS

A. In Underground Subdrainage Piping:

1. At Grade in Earth: Cast-iron or PVC cleanouts.
2. At Grade in Paved Areas: Cast-iron cleanouts.

B. In Underslab Subdrainage Piping:

1. In Equipment Rooms and Unfinished Areas: Cast-iron cleanouts.
2. In Finished Areas: Copper-alloy cleanouts.

3.5 FOUNDATION DRAINAGE INSTALLATION

A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches deep and 12 inches wide.

B. Place impervious fill on subgrade adjacent to bottom of footing and compact to dimensions indicated, but not less than 6 inches deep and 12 inches wide after concrete footing forms have been removed.

C. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

D. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

E. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

F. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.

G. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

H. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

I. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

J. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

K. Install vertical drainage panels as follows:

1. Coordinate placement with other drainage materials.
2. Lay perforated drainage pipe at base of footing. Install as indicated in Part 3 "Piping Installation" Article. Do not install aggregate.

3. Separate 4 inches of fabric at beginning of roll and cut away 4 inches of core. Wrap fabric around end of remaining core.
4. Wrap bottom of panel around drainage pipe.
5. Attach panel to wall at horizontal mark and at beginning of pipe. Place core side of panel against wall. Use concrete nails with washers through product cylinders to attach panel to wall. Place nails from 2 to 6 inches below top of panel, approximately 48 inches apart. Construction adhesives, metal stick pins, or double- double-sided tape may be used instead of nails. Do not penetrate waterproofing. Before using adhesives, discuss with waterproofing manufacturer.
6. If additional panels are required on same row, cut away 4 inches of installed panel core, install new panel against installed panel, and overlap new panel with installed panel fabric.
7. If additional rows of panels are required, overlap lower panel with 4 inches of fabric.
8. Cut panel as necessary to keep top 12 inches below finish grade.
9. For inside corners, bend panel. For outside corners, cut core to provide 3 inches for overlap.

L. Do not use drainage panels as protection for waterproof membrane unless approved by factory-authorized service representative of waterproofing membrane manufacturer. Submit approval if so used.

M. Place initial backfill material over compacted drainage course . Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

3.6 UNDERSLAB DRAINAGE INSTALLATION

A, Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for underslab subdrainage.

F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.

H. Install horizontal drainage panels as follows:

1. Coordinate placement with other drainage materials.
2. Lay perforated drainage pipe at inside edge of footings.
3. Place drainage panel over drainage pipe with core side up. Peel back fabric and wrap fabric around pipe. Locate top of core at bottom elevation of floor slab.

4. Butt additional panels against other installed panels. If panels have plastic flanges, overlap installed panel with flange.

3.7 PLAZA DECK DRAINAGE INSTALLATION

A. Horizontal Drainage Panel: Install between slab and floor cover. Place core on structural floor. Install panels to fit tightly around floor drains of building's storm drainage system. Provide stormwater access into floor drain.

1. Install drainage piping as indicated in Part 3 "Piping Installation" Article for plaza deck subdrainage.

B. See Division 32.

3.8 RETAINING-WALL DRAINAGE INSTALLATION

A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches.

C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

D. Install drainage piping as indicated in Part 3 "Piping Installation" Article for retaining-wall subdrainage.

E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

G. Place drainage course in layers not exceeding 3 inches in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.

H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

I. Install vertical drainage panels as follows:

1. Coordinate placement with other drainage materials.
2. Lay perforated drainage pipe at base of footing as described elsewhere in this Specification. Do not install aggregate.
3. If weep holes are used instead of drainage pipe, cut 1/2-inch- diameter holes on core side at weep-hole locations. Do not cut fabric.
4. Mark horizontal calk line on wall at a point 6 inches less than panel width above footing bottom. Before marking wall, subtract footing width.
5. Separate 4 inches of fabric at beginning of roll and cut away 4 inches of core. Wrap fabric around end of remaining core.
6. Wrap bottom of panel around drainage pipe.
7. Attach panel to wall at horizontal mark and at beginning of wall corner. Place core side of panel against wall. Use concrete nails with washers through product. Place nails from 2 to 6 inches below top of panel, approximately 48 inches apart. Construction adhesives,

metal stick pins, or double-sided tape may be used instead of nails. Do not penetrate waterproofing. Before using adhesives, discuss with waterproofing manufacturer.

8. If another panel is required on same row, cut away 4 inches of installed panel core and wrap fabric over new panel.
9. If additional rows of panel are required, overlap lower panel with 4 inches of fabric.
10. Cut panel as necessary to keep top 12 inches below finish grade.
11. For inside corners, bend panel. For outside corners, cut core to provide 3 inches for overlap.
12. Do not use drainage panels as protection for waterproof membrane unless approved by factory-authorized service representative of waterproofing membrane manufacturer. Submit approval if so used.

J. Fill to Grade: Place satisfactory soil fill material over compacted drainage course . Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.9 LANDSCAPING DRAINAGE INSTALLATION

A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

D. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least 6 inches between conduit and trench walls. Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with adhesive or tape.

E. Add drainage course to top of drainage conduits.

F. After satisfactory testing, cover drainage conduit to within 12 inches of finish grade.

G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

I. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.10 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Foundation Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated.
2. Underslab Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent.
3. Plaza Deck Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 1.0 percent.

4. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated. However, when water discharges through wall weep holes, pipe may be installed with a minimum slope of zero percent.
5. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated.
6. Lay perforated pipe with perforations down.
7. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install PE piping according to ASTM D 2321.

D. Install PVC piping according to ASTM D 2321.

3.11 PIPE JOINT CONSTRUCTION

A. Cast-Iron Soil Pipe and Fittings: Hub and spigot, with rubber compression gaskets according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook." Use gaskets that match class of pipe and fittings.

B. Join PE pipe, tubing, and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II.

C. Join perforated, PE pipe and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II.

D. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.

E. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose bell-and-spigot joints.

F. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.12 CLEANOUT INSTALLATION

A. Cleanouts for Foundation Retaining-Wall and Landscaping Subdrainage:

1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. In vehicular-traffic areas, use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches in depth. Set top of cleanout flush with grade. Cast-iron pipe may also be used for cleanouts in nonvehicular-traffic areas.
3. In nonvehicular-traffic areas, use NPS 4 cast-iron or PVC pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches in depth. Set top of cleanout plug 1 inch above grade.

B. Cleanouts for Underslab Subdrainage:

1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. Use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

3.13 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.

C. Where required, connect low elevations of foundation and underslab subdrainage to stormwater sump pumps.

3.14 IDENTIFICATION

A. Materials and their installation are specified in Division 31. Arrange for installation of green detectable warning tapes directly over piping.

1. Install PE warning tape or detectable warning tape over ferrous piping.
2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.15 FIELD QUALITY CONTROL

A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.16 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION