

March 17, 2011

PROJECT MANUAL

CITY OF GAINESVILLE CONE PARK – 2011 IMPROVEMENTS

FRED CONE PARK MULTI-PURPOSE FIELD DEVELOPMENT
BID NO. WSPP110038-PJ

201 S.E. 27th Street (fronts on East University Avenue at 27th St.)
Gainesville, Florida



606 N.E. First Street • Gainesville, Florida 32601 • Phone (352) 372-0425 •
FAX (352) 372-0427

Corp. Lic. No. AA C002304

Sputo & Lammert Engineering, LLC
Structural Engineers
P.E. Number 39142, CA-6855
Phone (352) 378-0448 FAX (352) 373-1331

Causseaux, Hewett & Walpole, Inc.
Consulting Civil Engineers
CA-5075
Phone (352) 331-1976 • FAX (352) 331-2476

Moses & Associates, Inc.
Mechanical/Plumbing/Electrical Engineers
CA-3097
Phone (352) 372-1911 Fax (352) 372-0186

Buford Davis + Associates
Landscape Architects
LC0000033
Phone (352) 335-1896 Fax (352) 373-6407

File No. 4309.020

SET NO.

BID DOCUMENTS

TABLE OF CONTENTS

CONTRACTUAL CONDITIONS

<u>Section</u>	<u>Description</u>	<u>Page Numbers</u>
A	General Conditions.....	A-1
B	Supplementary Conditions	B-1 thru B-4
C	Payment Forms	C-1 thru C-2
D	Contract Specifications and Drawings.....	D-1 thru D-2

TECHNICAL SPECIFICATIONS

<u>Section</u>	<u>Description</u>	<u>Page Numbers</u>
----------------	--------------------	---------------------

DIVISION 1 - GENERAL REQUIREMENTS

01010	Summary of the Work.....	01010-1
01230	Alternates	01230-1 thru 01230-3
01310	Schedules, Reports, Payments	01310-1 thru 01310-4
01340	Shop Drawings, Product Data and Samples	01340-1 thru 01340-4
01400	Standards and Quality Control	01400-1 thru 01400-4
01500	Temporary Facilities	01500-1 thru 01500-7
01770	Closeout Procedures.....	01770-1 thru 01770-6

DIVISION 2 - SITE WORK

02221	Building Demolition.....	02221-1 thru 02221-5
02300	Earthwork	02300-1 thru 02300-11
02361	Termite Control.....	02361-1 thru 02361-4
02821	Chain-Link Fences and Gates.....	02821-1 thru 02821-7
02940	BSS 300 Embedded Synthetic Track Surfacing System.....	02940-1 thru 02940-5
02941	Asphalt Pavement for Synthetic Surfaced Running Tracks.....	02941-1 thru 02941-16

DIVISION 3 - CONCRETE

03300	Cast-In-Place Concrete	03300-1 thru 03300-16
-------	------------------------------	-----------------------

DIVISION 4 - MASONRY

04810	Unit Masonry Assemblies.....	04810-1 thru 04810-12
-------	------------------------------	-----------------------

DIVISION 5 - METALS

Not Used

<u>Section</u>	<u>Description</u>	<u>Page Numbers</u>
----------------	--------------------	---------------------

DIVISION 6 - CARPENTRY

06100	Rough Carpentry.....	06100-1 thru 06100-6
06176	Metal-Plate-Connected Wood Trusses	06176-1 thru 06176-6

DIVISION 7 - MOISTURE PROTECTION

07210	Building Insulation.....	07210-1 thru 07210-3
07311	Asphalt Shingles	07311-1 thru 07311-8
07461	Fiber Cement Sheathing	07461-1 thru 07461-3
07620	Sheet Metal Flashing and Trim	07620-1 thru 07620-8
07920	Joint Sealants.....	07920-1 thru 07920-12

SECTION 8 - DOORS, WINDOWS & GLASS

08110	Steel Doors and Frames	08110-1 thru 08110-6
08311	Access Doors and Frames.....	08311-1 thru 08311-4
08710	Finish Hardware	08710-1 thru 08710-14

DIVISION 9 - FINISHES

09220	Portland Cement Plaster	09220-1 thru 09220-6
09260	Gypsum Board Assemblies.....	09260-1 thru 09260-6
09310	Ceramic Tile	09310-1 thru 09310-11
09912	Painting (Professional Line Products)	09912-1 thru 09912-15

DIVISION 10 - SPECIALTIES

10431	Signs	10431-1 thru 10431-5
10520	Fire Protection Specialties	10520-1 thru 10520-3
10801	Toilet and Bath Accessories.....	10801-1 thru 10801-5

DIVISION 11 - EQUIPMENT

11490	Playground and Track Equipment.....	11490-1 thru 11490-3
-------	-------------------------------------	----------------------

DIVISION 12 - FURNISHINGS

Not Used

DIVISION 13 - SPECIAL CONSTRUCTION

Not Used

DIVISION 14 - CONVEYING SYSTEMS

Not Used

<u>Section</u>	<u>Description</u>
----------------	--------------------

DIVISION 15 - MECHANICAL

15005	Mechanical General
15020	Codes and Standards
15030	Mechanical Related Work
15105	Pipes and Pipe Fittings
15110	Valves
15120	Piping Specialties
15140	Meters and Gauges
15150	Supports, Anchors, and Seals
15160	Mechanical Identification
15180	Testing, Cleaning, and Sterilization of Piping Systems
15190	Excavation and Backfill
15205	Insulation for Plumbing Equipment and Piping
15405	Potable Water System
15410	Soil, Waste and Vent System
15430	Plumbing Fixtures, Equipment, Trim & Schedule
15810	Fans
15840	HVAC Metal Ductwork
15855	Ductwork Accessories
15860	Grilles, Registers and Ceiling Diffusers
15970	Startup Requirements for HVAC Systems
15985	Testing and Balancing of Mechanical Systems

DIVISION 16 - ELECTRICAL

16005	Electrical General
16020	Codes and Standards
16030	Electrical Related Work
16100	Basic Electrical Materials and Methods
16101	Electrical Identification
16103	Grounding and Bonding
16105	Excavation and Backfill
16107	Service Entrance Methods and Materials-Underground
16112	Fuses 600 Volts and below
16120	Enclosed Switches and Circuit Breakers
16150	Lighting Control Devices
16170	Wiring Devices
16420	Panelboards
16510	Occupancy Sensors
16520	Interior Lighting
16900	Work Required for Equipment Furnished By Other Divisions

END TABLE OF CONTENTS

SECTION A - GENERAL CONDITIONS

GENERAL CONDITIONS, AIA DOCUMENT A201, 2007 EDITION

General Conditions of the Contract for Construction, AIA Document A201 of the American Institute of Architects, Sixteenth Edition, 2007, except as eliminated, changed or modified in the basic contract or in other Contract Documents, by this reference are made a part of the Contract for Construction between the Owner and the Contractor. Copies of these AIA General Conditions are on file in the office of the Architect/Engineer and may be examined upon request.

END OF SECTION A

SECTION B - SUPPLEMENTARY CONDITIONS

MODIFICATIONS TO AIA GENERAL CONDITIONS: The following supplements modify, change, delete from or add to the General Conditions of the Contract for Construction, AIA Document A201, Sixteenth Edition, 2007. Where any Article of the General Conditions is modified or any paragraph, subparagraph or clause thereof is modified or deleted by these supplements, the unaltered provisions of that Article, paragraph, subparagraph or clause shall remain in effect.

ARTICLE 1 GENERAL PROVISIONS

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

1.2.1 Add the following to this subparagraph:

In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.

ARTICLE 2 OWNER

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.2.2 Add the following to this subparagraph:

As it relates to sanitary sewer and water utility services, the Owner shall pay any applicable capital facilities fees or front footage fees, tap fees, water meters, or other required equipment items related to services provided by the utility entity.

2.2.5 Delete this subparagraph in its entirety and substitute the following:

Owner will provide Contractor, free of charge, 10 sets of Drawings and Project Manuals. Additional sets are to be paid for by the Contractor.

ARTICLE 3 CONTRACTOR

3.5 WARRANTY

Add the following subparagraph:

3.5.1 The warranty required by Paragraph 3.5 shall be in addition to and not in limitation of any other warranty required by the Contract Documents or otherwise prescribed by law.

3.14 CUTTING AND PATCHING

Add the following subparagraph:

3.14.3 Existing structures and facilities, including but not limited to buildings, utilities, topography, streets, curbs, sidewalks, landscape materials and other improvements that are damaged or removed due to Contractor's work, shall be patched, repaired, or replaced by the Contractor to the satisfaction of the Architect and authorities having jurisdiction. In the event that local authorities having jurisdiction require that such repairing and patching be done with their own labor and materials, the Contractor shall abide by such regulations and pay for such work.

ARTICLE 5 SUBCONTRACTORS

5.4.2 Delete this subparagraph in its entirety.

ARTICLE 7 CHANGES IN THE WORK

7.3 CONSTRUCTION CHANGE DIRECTIVES

7.3.7 In the first sentence of this subparagraph, delete the words "a reasonable allowance for overhead and profit" and substitute "an allowance for overhead and profit in accordance with Clauses 7.3.11 .1 through .10 below."

Add the following to the end of Subparagraph 7.3.7:

Costs shall not include any of the following:

- .6 Salaries or other compensation of the Contractor's personnel at the Contractor's office, including the field office, unless direct additional expenses have been incurred exclusively because of the change;
- .7 Expenses of the Contractor's offices, including the field office;
- .8 Any part of the Contractor's capitol expenses, including interest on the Contractor's capitol;
- .9 Costs due to the negligence of the Contractor, any Subcontractor, any Sub-subcontractor, anyone directly or indirectly employed by them, or for whose acts any of them may be liable, including but not limited to, the correction of defective or non-conforming Work, disposal of materials and equipment wrongly supplied, or making good any damage to property;
- .10 Overhead, general expense, and the cost of any item not specifically or reasonably inferable as included in the items described in 7.3.7.1 through 7.3.7.5.

Add the following Subparagraph 7.3.11 to 7.3:

7.3.11 In Subparagraph 7.3.7, the allowance for the combined overhead and profit included in the total cost to the Owner shall be based on the following schedule:

- .1 For the Contractor, for Work performed by the Contractor's own forces, 15 percent of the cost.
- .2 For the Contractor, for Work performed by the Contractor's Subcontractor, 7-1/2 percent of the amount due the Subcontractor.
- .3 For each Subcontractor or Sub-subcontractor involved, for Work performed by that Subcontractor's or Sub-subcontractor's own forces, 15 percent of the cost.
- .4 For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, 7-1/2 percent of the amount due the Sub-subcontractor.
- .5 Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.7.
- .6 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also.

ARTICLE 9 PAYMENTS AND COMPLETION

9.11 TIME OF COMPLETION AND LIQUIDATED DAMAGES

The time of completion of the project is of great importance to the Owner. It is highly desirable that the project be completed and ready for occupancy at the earliest possible time. Work is to commence when the Contractor is given written Notice to Proceed and is to be substantially complete within the following schedule:

- A. 180 calendar days to Substantial Completion and 30 days thereafter for Final Completion after the date of such Notice.

The Contractor is to furnish sufficient forces, construction plant and equipment, and to work such hours, including overtime operations, as may be necessary to insure the prosecution of the work, to allow the substantial completion of the project within the specified time. Normal inclement weather will not be sufficient reason to allow an extension of time on the project. Only exceptional weather conditions, acts of God which might cause delay in the work or other factors outlined in Paragraph 8.3.1 of AIA General Conditions will be considered as justifiable reasons for an extension of time.

Failure on the part of the Contractor to comply with the conditions of the basic Contract concerning the time in which the work is to be completed will be considered by the Owner as a justifiable reason to invoke the conditions of Article 14, Paragraph 14.2, of AIA General Conditions, relating to termination; or, at its sole option, to avail itself of the rights under the following paragraph concerning liquidated damages.

Bidders are informed that the following paragraphs concerning liquidated damages will be inserted in the basic Contract:

Inasmuch as failure to complete the work within the time herein fixed will result in substantial injury to the Owner, and whereas damages arising from such failure cannot be calculated with any degree of certainty, it is hereby agreed that if such work is not substantially completed as herein defined within the time fixed herein or within such further time, if any, as shall be allowed for such performance of completion in accordance with the provisions of this Agreement, the Contractor shall pay to the Owner, as liquidated damages for such delay and not as a penalty, \$500.00 per day for each and every calendar day after the date fixed for such substantial completion for the project, until such substantial completion shall have been fully accomplished.

It is also further agreed that if the work is not finally completed, without justifiable cause and extension of time by the Owner, within 30 days after substantial completion, the Contractor shall pay to the Owner, as liquidated damages for such delay, 50% of the rate indicated above.

This provision for liquidated damages for delay shall in no manner affect the Owner's right to terminate the Contract, as provided in Article 14.2 of AIA General Conditions or elsewhere in the Contract Documents; and the Owner's exercise of the right to terminate shall not release the Contractor from his obligation to pay said liquidated damages, in the amounts hereinbefore set out. Said liquidated damages shall be payable in addition to any excess expenses or costs payable by the Contractor under said Article 14.2 of AIA General Conditions and shall not exclude recovery of damages by the Owner under other provisions of the Contract, except for the Contractor's delays.

ARTICLE 11 INSURANCE AND BONDS

SEE INVITATION TO BID

ARTICLE 13 MISCELLANEOUS PROVISIONS

13.6 INTEREST

13.6.1 Add the following sentence to this paragraph:

Interest shall be paid in certain cases as provided by Section 215.422, Florida Statutes.

Add the following subparagraph:

13.6.2 The Contractor shall be required to pay interest to Subcontractors and Suppliers in certain cases where payments are not within the time constraints of Section 287.0585, Florida Statutes.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

14.4.3 Delete this paragraph and replace with the following:

In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination.

END OF SECTION B

SECTION C - PAYMENT FORMS

FORM FOR CERTIFICATE FOR PARTIAL PAYMENT

Date _____ For Period Ending _____ Payment No. _____

CONTRACTOR: _____

CONTRACT FOR: City of Gainesville
 Cone Park 2011 Improvements
 Gainesville, Florida

Original Contract Sum	\$ _____	Contract Time	_____	Cal. Days
Additions to Date	_____	Author. Extension	_____	Cal. Days
Total	\$ _____	Pending Requests	_____	Cal. Days
Deductions to Date	_____	Time Lapsed to Date	_____	Cal. Days
Adjusted Contract Sum	\$ _____			

WORK PERFORMED TO DATE \$ _____

MATERIAL SUITABLY STORED

(Itemized list of materials attached)

TOTAL TO DATE \$ _____

Less Retainage @ 5% \$ _____

Less Previous Payments _____

TOTAL DEDUCTIONS _____

DUE THIS PAYMENT \$ _____

CERTIFICATION OF CONTRACTOR: According to the best of my knowledge and belief, I certify that all items and amounts shown on the face of this Certificate are correct and that all Work has been performed and material supplied in full accord with the terms and conditions of the contract. I further certify that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

Date _____ Contractor _____

NOTARIZATION:

State of: _____ County of: _____

Subscribed and sworn to before me this _____ day of _____, 20_____

Notary Public:

My Commission expires: _____

CERTIFICATION OF ARCHITECT/ENGINEER: I certify that I have checked and verified this Certificate; that, to the best of my knowledge and belief, based on on-site observations and the data comprising the above application, the Work has progressed to the point indicated; the quality of the Work is in accordance with the Contract Documents; and that the Contractor is entitled to payment of the amount certified.

Amount Certified \$ _____

Date _____ Architect/Engineer _____

APPROVED FOR PAYMENT:

Owner _____

Date _____ By _____

(Use this form as a GUIDE, expanding to show, in detail, each other trade, using appropriate units for each.)

SCHEDULE OF VALUES

Project Name City of Gainesville – Cone Park 2011 Improvements, Gainesville, Florida

Contractor's Name _____ Date _____

Div. No.	Description of Work	Unit Qty.	Contract Value				Completed to Date
			Material	Labor	Total	%	
1	General Conditions						
	A. Insurance						
	B. Temporary Bldgs.						
	C. Cleanup of Work						
	D. Other						
2	Site Work						
	A. Site Preparation						
	B. Earthwork						
	C. Soil Treatment						
	D. Landscaping						
	E. Paving						
	F. Site Utilities						
	G. Cleanup & Fin. Grading						
3	Concrete						
Etc.	(Give Similar Breakdown)						
15	Mechanical						
	A. Rough-in Plumbing						
	B. Fixtures & Floor Drains						
	C. AC Ducts, Grilles						
	D. AC, Heat. & Cont. Equip.						
16	Electrical						
	A. Panels						
	B. Fixtures						
	C. Wiring Devices						
	D. Conduit & Wire						
	E. Boxes & Fittings						
	F. Alarm & Signal System						
TOTALS							

Subcontractors who have performed on-site labor this month and are included in this request are as follows:

_____	_____
_____	_____
_____	_____

END OF SECTION C

SECTION D - CONTRACT SPECIFICATIONS AND DRAWINGS

SPECIFICATIONS: Broadly defined the specifications include all data bound together or referenced within the Project Manual, including Instructions to Bidders, Bid Form, List of Subcontractors Form, General Conditions, Supplementary Conditions, detailed Technical Specifications and all Addenda thereto. The Project Manual is entitled:

City of Gainesville
Cone Park 2011 Improvements
Gainesville, Florida
(4309.020)

The Project Manual is dated March 17, 2011. The contents are as shown in the Table of Contents.

DRAWINGS: The drawings, or reproductions thereof, pertain to the work to be performed and have been prepared or approved by the Architect/Engineer. The drawings consist of the following sheets dated March 17, 2011.

<u>NUMBER</u>	<u>TITLE</u>
I1.1	COVER SHEET, INDEX, LOCATION MAP
C1 OF 1	TOPOGRAPHIC SURVEY
C0.10	GENERAL NOTES AND LEGEND
C0.20	DEMOLITION PLAN
C1.00	MASTER SITE PLAN
C1.10	HORIZONTAL CONTROL AND SITE PLAN
C1.20	HORIZONTAL CONTROL AND SITE PLAN
C2.00	MASTER GRADING, DRAINAGE AND UTILITY PLAN
C2.10	GRADING, DRAINAGE AND UTILITY PLAN
C2.20	GRADING, DRAINAGE AND UTILITY PLAN
C2.30	STORMWATER MANAGEMENT FACILITY DETAILS
C3.00	CONSTRUCTION DETAILS
C4.00	STORMWATER POLLUTION PREVENTION PLAN
C4.10	STORMWATER POLLUTION PREVENTION NOTES
LS-1	LANDSCAPE PLAN
LS-2	LANDSCAPE PLAN
LS-3	LANDSCAPE PLAN
LS-4	LANDSCAPE PLAN
LS-5	LANDSCAPE PLAN
P-1	PHOTOMETRIC PLAN
A1.1	REST ROOM BUILDING - FLOOR PLAN, BUILDING ELEVATIONS, FINISH SCHEDULE, INTERIOR ELEVATIONS
A2.1	REST ROOM BUILDING - REFLECTED CEILING PLAN, ROOF PLAN, DOOR SCHEDULE AND DETAILS
A3.1	DUMPSTER ENCLOSURE - PLAN AND DETAILS

- S1.1 FOUNDATION PLAN, ROOF FRAMING PLAN, NOTES & DETAILS
- M1.1 FIRST FLOOR PLAN - MECHANICAL
- P1.1 FIRST FLOOR PLAN - PLUMBING
- E1.1 ELECTRICAL LEGEND, NOTES, DETAILS, SCHEDULES AND SINGLE LINE
DIAGRAM
- E1.2 SITE PLAN AND FIRST FLOOR PLAN

END OF SECTION D

SECTION 01010 - SUMMARY OF THE WORK

1.0 GENERAL

Work described in this Project Manual and delineated on the Contract Drawings is for the construction of various improvements at Cone Park in Gainesville, Florida.

BRIEF DESCRIPTION: The Base Bid includes the demolition and new construction for the construction of the parking lot (both paved and unpaved), connection to SE 27th Street and SR 26, sidewalk, storm infrastructure, expansion of the stormwater facility, new water lines, new sewer lines, modification to existing sewer lines, electric infrastructure, sports track, bleachers, basketball courts, lighting, and landscaping, as shown on the plans. The western run of north-south sidewalk from the existing community center, south to the restroom area, and east to the basketball courts is included in the Base Bid. Demolition includes tree removal and removal of the existing basketball courts in the southwest area of the park, and the capping of the drain pipe in the same vicinity.

The base bid excludes the items listed below in the alternates, including the eastern run of north-south sidewalk on the east side of the splash pad, running from the existing community center to the proposed restroom area.

- Construction of the new restroom facility
- Construction of the splash pad facility
- Construction of the picnic pavilions
- Demolition of the existing restroom facility
- Construction of sports lighting for the track and interior field area

END OF SECTION 01010

SECTION 01230 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. ADDITIVE ALTERNATE NO. 1: CONSTRUCTION OF THE NEW RESTROOM FACILITY

WORK INCLUDED UNDER BASE BID: Miscellaneous underground rough-in work is required in the general area of the New Restroom Facility, and other minor improvements as indicated on the drawings. No other work is required in the area of the Splash Pad Facility.

WORK INCLUDED IF ALTERNATE NO. 1 IS ACCEPTED: Furnish and install all materials for the New Restroom Facility as indicated on the drawings and specifications. The work also includes surrounding concrete pavement and sidewalk areas as indicated.

B. ADDITIVE ALTERNATE NO. 2: ALLOWANCE OF \$150,000 FOR THE CONSTRUCTION OF THE SPLASH PAD FACILITY

WORK INCLUDED UNDER BASE BID: Miscellaneous underground rough-in work is required in the general area of the Splash Pad Facility, and other minor improvements as indicated on the drawings. No other work is required in the area of the Splash Pad Facility.

WORK INCLUDED IF ALTERNATE NO. 2 IS ACCEPTED: Include the sum of \$100,000 in the contract for the design and installation of the Splash Pad Facility.

C. ADDITIVE ALTERNATE NO. 3: CONSTRUCTION OF THE PICNIC PAVILIONS

WORK INCLUDED UNDER BASE BID: No work required in the area of the Picnic Pavilions.

WORK INCLUDED IF ALTERNATE NO. 3 IS ACCEPTED: Furnish and install all materials for the four picnic pavilion pads and structures as indicated on the drawings.

D. ADDITIVE ALTERNATE NO. 4: DEMOLITION OF THE EXISTING RESTROOM FACILITY

WORK INCLUDED UNDER BASE BID: The existing Restroom Facility will remain as is.

WORK INCLUDED IF ALTERNATE NO. 4 IS ACCEPTED: Demolish the existing restroom facility in the southwest area of the park. Demolition includes the removal and capping of existing utilities to one foot below grade.

E. ADDITIVE ALTERNATE NO. 5: CONSTRUCTION OF SPORTS LIGHTING FOR THE TRACK AND INTERIOR FIELD AREA

WORK INCLUDED UNDER BASE BID: No sports lighting is required.

WORK INCLUDED IF ALTERNATE NO. 5 IS ACCEPTED: The construction of sports lighting for the sports track and interior field area. Lighting shall be by Musco and will consist of a four poles to light the track and interior sports field. Lighting shall be of a design to minimize spill light and minimize life cycle costs through energy efficiency, controls, and maintenance savings. The lighting shall include Musco's Control-Link system for easy management of the lighting system through an easy-to-use scheduling system accessible via the web. The lighting shall provide 30 foot-candles within +/- 10% per IESNA guidelines. Lighting equipment shall meet structural codes and wind speed requirements. The contractor must provide the conduits from the electrical panel to the first light pole with appropriate pedestal / enclosure and conduits to each of the other light poles.

END OF SECTION 01230

SECTION 01310 - SCHEDULES, REPORTS, PAYMENTS

1.0 - GENERAL

RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section.

COORDINATION: Coordinate both the listing and timing of reports and other activities required by provisions of this and other sections, so as to provide consistency and logical coordination between the reports. Maintain coordination and correlation between separate reports by updating at monthly or shorter time intervals. Make appropriate distribution of each report and updated report to all parties involved in the work including the Architect/Engineer and Owner. In particular provide close coordination of the progress schedule, schedule of values, listing of subcontracts, schedule of submittals, progress reports, and payment requests.

PROGRESS SCHEDULE: Based on the preliminary development of the progress schedule, if any, and on whatever updating and feedback may have occurred during the project start-up, secure critical time commitments for performing major elements of the work. Within 30 days after the date established for "commencement of the work", submit a comprehensive bar-chart type progress schedule indicating, by stage-coded symbols, a time bar for each major category or unit of work to be performed at the site; include minor elements of work which are, nevertheless, involved in overall sequencing of the work. Arrange schedule to show graphically the major sequences of work necessary for the completion of related elements of work. Arrange the schedule to show how substantial completion is scheduled to allow for the Architect's procedure for certification of substantial completion. Prepare and maintain the schedule on either a sheet of sufficient width (or else a series of sheets) to show the required data clearly for the entire Construction Time.

CONTRACTOR'S OBLIGATION TO COMPLY WITH SCHEDULE AND CONTRACT TIME: The Contractor shall furnish sufficient forces, construction plant and equipment and shall work such hours, including night shifts and overtime operations, as may be necessary to insure the prosecution of the work in accordance with the approved progress schedule. If the Contractor falls behind the progress schedule, the Contractor shall take such steps as may be necessary to improve his progress by increasing the number of shifts, overtime operations, days of work and the amount of construction plant, all without additional cost to the Owner.

(Note: Should the Contractor need to work overtime, etc., the Contractor must comply with all City ordinances with respect to noise in the execution of the work.)

Failure of the Contractor to comply with the requirements under this provision shall be grounds for determination by the Architect that the Contractor is not prosecuting the work with such diligence as will insure completion within the time specified, and such failure constitutes a substantial violation of the conditions of the Agreement.

NOTICE OF COMMENCEMENT: Prior to starting construction the Contractor shall confirm he has filed and recorded with the Clerk of Circuit Court a Notice of Commencement together with a copy of the Contract Bond (if Bond is required by Owner) in accordance with Section 713.13 Florida Statutes. A copy of the Notice of Commencement shall be posted on the job.

PROGRESS MEETINGS, REPORTING:

GENERAL: Hold a general progress meeting each month with time coordinated with preparation of the payment request. Require each entity then involved in planning, coordination or performance of work to be properly represented at each meeting. Discuss whether each element of current work is ahead of schedule, on time, or behind schedule in relation with updated progress schedule. Determine how behind-schedule work will be expedited, and secure commitments from entities involved in doing so. Discuss whether schedule revisions are required to ensure that current work and subsequent work will be completed within Contract Time. Review everything of significance which could affect progress of the work.

SCHEDULE OF VALUES:

GENERAL: Prepare the schedule of values, as required by the General Conditions, in conjunction with the preparation of the progress schedule. Coordinate preparation of schedule of values and progress schedule. Correlate line items with other administrative schedules and the forms required for the work, including the progress schedule, payment request form, listing of subcontractors, schedule of allowances, schedule of alternates, listing of products and principal suppliers and fabricators, and the schedule of submittals. Provide breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of payment requests and progress reports. Break down principal subcontract amounts into several line items. Round off to the nearest whole dollar, but with the total equal to the Contract Sum.

SUB-SCHEDULES: Where the work is separated into phases which require separately phased payments to the Contractor, provide sub-schedules showing values correlated with each phase of payment.

UNIT COST ALLOWANCES: Show the line item value as a product of the unit cost x measured quantity as estimated from the best indication in the contract documents.

TIME COORDINATION: In coordination of initial submittals and other administrative "start-up" activities, submit the schedule of values to the Architect at the earliest feasible date, but in no case later than 14 days before initial payment request is to be submitted.

FORMAT FOR SCHEDULE OF VALUES: Arrange the schedule with line items to indicate the generic name of item and related specification sections with columns giving the quantity, material value, labor value, total value, percent complete, amount completed to date, amount previously requested and amount of this request. All amounts shall include prorata shares of overhead and profit and other general overhead not included in a line item. Total columnar footings shall equal contract sum. The Schedules of Values shall be in a format similar to the sample form under Conditions of the Contract.

DIRECT AND INDIRECT COST ITEMS: Show line items of indirect costs, and margins on actual costs, only to the extent such items will be individually listed in payment requests. In general, each item in the schedule of values and in payment requests shall be established to be complete with its total expenses and proportionate share of the general overhead and profit margin. Except as otherwise indicated, those major cost items that are not directly the cost of actual work-in-place, such as distinct temporary facilities, may be

either shown as line items in the schedule of values or may be distributed as general overhead expense, at Contractor's option.

CHANGE ORDERS: At the next request for payment following approval of a Change Order or Construction Change Directive, the Schedule of Values shall be changed to reflect such changes in the Contract. Break down the costs of such changes by separate line items as required to allow confirmation of costs in requests for payment.

SCHEDULE UPDATING: Update and resubmit schedule of values when change orders affect the listing and when the actual performance of the work involves necessary changes of substance to the values previously listed.

PAYMENT REQUESTS:

GENERAL: Refer to Article 9 of AIA General Conditions and to modifications and additions in Supplementary Conditions. Except as otherwise indicated, the progress payment cycle is to be regular. Each application must be consistent with previous applications and payments. Certain applications for payment, such as the initial application, the application at substantial completion, and the final payment application involve additional requirements.

WAIVER OF LIEN: Each progress payment must be submitted with Contractor's waiver for the period of construction covered by the application. After the first progress payment, each request for payment must be submitted with waivers from the subcontractors or sub-subcontractors and suppliers for the previous period of construction covered by the previous application. Such partial releases of lien shall be executed substantially in accordance with the form described in Section 713.20(4) Florida Statutes (1988). The final payment application must be submitted together with or preceded by final or complete waivers from every entity involved with performance of the work covered by the payment request.

WAIVER FORMS: Submit waivers on forms, and executed in a manner, acceptable to Owner.

PAYMENT APPLICATION TIMES: The "date" for each progress "payment" is as indicated in Owner-Contractor Agreement or, if none is indicated therein, it is the 15th day of each month. The period of construction work covered by each payment request is period indicated in Owner-Contractor Agreement or, if none is indicated therein, it is period ending 15 days prior to date for each progress payment, and starting day following end of preceding period.

PAYMENT APPLICATION FORMS: Use forms similar to the sample copy included under Bidding and Contractual Conditions.

APPLICATION PREPARATION: Except as otherwise indicated, complete every entry provided for on the form, including notarization and execution by authorized persons. Incomplete applications will be returned by Architect/Engineer without action. Entries must match current data of schedule of values and progress schedule and report. Listing must include amounts of change orders issued prior to last day of the "period of construction" covered by application.

INITIAL PAYMENT APPLICATION: The principal administrative actions and submittals which must precede or coincide with submittal of Contractor's first payment application can be summarized as follows, but not necessarily by way of limitation:

Listing of subcontractors and principal suppliers and fabricators.

Schedule of values.

Progress schedule (preliminary if not final).

Schedule of principal products.

Schedule of unit prices.

Schedule of submittals (when required).

Listing of Contractor's staff assignments and principal consultants.

Posting of required building permits and similar authorizations and licenses from governing authorities for current performance of the work.

APPLICATION AT TIME OF SUBSTANTIAL AND FINAL COMPLETION: Refer to Section 01700 - Project Closeout for requirements prior to submitting substantial completion and final completion requests for payment.

AMOUNT OF RETAINAGE: The Architect shall certify payment of 95% of the value of work and materials, according to his best judgment of the correct amount.

The remaining 5% shall be retained until completion of the work and acceptance by the Owner. Final payment to selected subcontractors completing their work early will be considered in which case a final release of lien will be required.

APPLICATION TRANSMITTAL: Submit 4 executed copies of each payment application, one copy of which is completed with waivers of lien and similar attachments. Transmit each copy with a transmittal form listing those attachments, and recording appropriate information related to application in a manner acceptable to Architect. Transmit to Architect by means ensuring receipt within 24 hours.

END OF SECTION 01310

SECTION 01340 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section. Refer particularly to Paragraph 3.12, Shop Drawings, Product Data and Samples, of AIA General Conditions.

1.2 GENERAL

- A. This section specifies procedural requirements for non-administrative submittals including shop drawings, product data, samples and other miscellaneous work-related submittals. Shop drawings, product data, samples and other work-related submittals are required to amplify, expand and coordinate the information contained in the Contract Documents.
 - 1. Refer to other Division-1 sections and other contract documents for specifications on administrative, non-work-related submittals.

1.3 COORDINATION

- A. Coordinate the preparation and processing of submittals with the performance of the work. Coordinate each separate submittal with other submittals and related activities such as testing, purchasing, fabrication, delivery and similar activities that require sequential activity.
 - 1. Coordinate the submittal of different units of interrelated work so that one submittal will not be delayed by the Architect's need to review a related submittal. The Architect reserves the right to withhold action on any submittal requiring coordination with other submittals until related submittals are forthcoming.
- B. Coordination of Submittal Times: Prepare and transmit each submittal to the Architect sufficiently in advance of the scheduled performance of related work and other applicable activities. Transmit different kinds of submittals for the same unit of work so that processing will not be delayed by the Architect's need to review submittals concurrently for coordination.
 - 1. It shall also be the responsibility of the Contractor to coordinate the preparation of shop drawings and product data of items which will be furnished by more than one manufacturer but which are designed to interface when installed.
- C. Review Time: It shall be the responsibility of the Contractor to properly schedule the submission of shop drawings and product data for approval to allow adequate time for checking of drawings and the manufacture and shipment of items to the job site

in sufficient time to prevent delay in the progress schedule. Advise the Architect on each submittal as to whether or not processing time is critical to the progress of the work and if the work would be expedited if processing time could be shortened.

The Owner will not grant a time extension based on delays due to the improper scheduling of submittals, which might result in a delay in the Work; and the Owner, at the Owner's discretion, may withhold progress payments until such time as these requirements are fully satisfied.

1.4 SPECIFIC SUBMITTAL REQUIREMENTS

- A. Shop drawings and product data shall be submitted for manufactured or fabricated materials as called for in the separate specification sections. Drawings shall be fully identified by project name, location, supplier's name, date, drawing number, specification section reference, etc. The Contractor shall submit, with such promptness as to cause no delay in his work or in that of any other contractor, four copies (in addition to those copies necessary for his own requirements) of all shop drawings, product data and schedules, required for the work of the various trades, to the Architect/ Engineer, for approval. The Contractor shall make no deviation from the approved shop drawings and the changes made thereto by the Architect/Engineer, if any.

Submittals shall have a two part numbering system. The first number shall reflect the division of work to which it applies, and the second number sequential for each item submitted. For example, 4-3 denotes that the submittal is for the masonry section and is the third submittal made in that section (see illustration below).

COPIES	DATE	NO.	DESCRIPTION	ACTION
6		2-1	Precast Structures	
7		4-1	Brick Submittal and Samples	
5		4-2	Mortar Submittal	
5		6-1	Casework Submittal and Chart	

1.5 REVIEW AND APPROVAL OF SHOP DRAWINGS AND PRODUCT DATA BY CONTRACTOR

- A. Shop drawings and product data submitted to the Architect for his approval shall first be checked and approved by the Contractor, the prima facie evidence of which shall be a "checked" stamp marked "Approved" or "Approved as Noted" on each copy of each shop drawing or product data, placed thereon by the Contractor. Shop drawings and product data received without the Contractor's "checked" stamp will be cause for immediate return without further action.

- Contractor's Stamp: Contractor shall stamp each submittal, indicating his review and approval. If only the front cover is stamped, then the entire submittal will be either approved or rejected. If each page is stamped, then

each page will be approved or rejected. Unstamped documents will not be reviewed.

- B. Architect's Action: Each drawing or data sheet correctly submitted will be checked by the Architect and marked by him in one of the following ways:
 - 1. No exception taken
 - 2. Rejected
 - 3. Make corrections noted
 - 4. Revise and resubmit
- C. Submittal Schedule: If and when required by the Architect, the Contractor shall prepare and shall submit, in triplicate, to the Architect, a completely itemized schedule of shop drawings, brochures and other descriptive literature, listing each and all such items as required under these specifications, which schedule shall indicate for each required item:
 - 1. Identification as to pertinent division.
 - 2. Item(s) involved.
 - 3. Name of pertinent subcontractor or supplier and name of pertinent manufacturer.
 - 4. Schedule date of delivery of pertinent items to the project.

1.6 BROCHURES ON MATERIAL AND EQUIPMENT

- A. The subcontractor for all phases of the contract shall submit, through the General Contractor, complete brochures covering all materials and/or equipment proposed for use in the execution of the work, as required by their respective divisions of the specifications. These brochures shall be indexed and properly cross-referenced to plans and specifications for easy identification.
- B. All shop drawings, setting drawings, material brochures, samples and/or color selection materials, which are required, shall be submitted via the General Contractor. Insofar as is possible OR PRACTICAL, all shop drawings or descriptive literature of equipment for the mechanical or electrical trades shall be submitted in a complete brochure for each trade, as soon as possible after Notice to Proceed is executed.

1.7 SAMPLES

- A. Furnish all samples as required by the contract documents, for the purpose of making color selections or to illustrate materials, equipment or workmanship and to establish standards by which the work will be judged.

1.8 COLOR SCHEDULES

- A. Not later than 30 calendar days after authorization to proceed with the contract work, submit to the Architect the names of all manufacturers and the trade names for all materials involving selections based upon color or texture which are proposed for actual use in the building. Color harmony demands that the schedules not be prepared on a piecemeal basis. The Architect will, therefore, require that

information on all items be submitted before selections and/or schedules are furnished on any items. If such information is not furnished by the Contractor within the required period, the Architect will select colors and textures from the products named in the specifications; and the Contractor will furnish and install the selected products.

1. Where samples are necessary to such selection, furnish same. This requirement applies to all such items as plastic laminate, paint, composition flooring, hard tile and any other items involving color. Color items even in the same range vary among different manufacturers' products; and it is, therefore, important that selections be made from the items actually intended for use in the work.

END OF SECTION 01340

SECTION 01400 - STANDARDS AND QUALITY CONTROL

1.0 - GENERAL

RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section.

DESCRIPTION OF REQUIREMENTS:

GENERAL: Required inspection and testing services are intended to assist in the determination of probable compliance of the work with requirements specified or indicated. These required services do not relieve the Contractor of responsibility for compliance with these requirements or for compliance with requirements of the contract documents.

DEFINITIONS: The requirements of this section relate primarily to customized fabrication and installation procedures, not to the production of standard products. Quality control services include inspections and tests and related actions including reports, performed by independent agencies and governing authorities, as well as directly by the Contractor. These services do not include Contract enforcement activities performed directly by the Architect or Engineer.

Specific quality control requirements for individual units of work are specified in the sections of these specifications that specify the individual element of the work. These requirements, including inspections and tests, cover both production of standard products, and fabrication of customized work. These requirements also cover quality control of the installation procedures.

Inspections, tests and related actions specified in this section and elsewhere in the contract documents are not intended to limit the Contractor's own quality control procedures which facilitate overall compliance with requirements of the contract documents.

Requirements for the Contractor to provide quality control services as required by the Architect/Engineer, the Owner, governing authorities or other authorized entities are not limited by the provisions of this section.

STANDARDS SET BY CODES AND REGULATIONS: The project is to be constructed within the boundaries of City of Gainesville, Florida and is, therefore, subject to all City ordinances and Codes, which shall be strictly adhered to. Construction shall meet the requirements of the Florida Building Code 2007 and the Florida Fire Preventions Code 2007.

The design has been based on requirements of the Florida Building Code; and while it is not the responsibility of the Contractor to verify that all work called for complies with this Code, the Contractor shall be responsible for calling to the Architect's attention any details or specifications that are not in conformance with this or other Codes. Where no specific method or form of construction is called for in the contract documents, the Contractor shall comply with Code requirements in carrying out such work.

Comply with regulations and Codes of suppliers of utilities; and comply with all other local, State and Federal regulations and standards concerning building construction.

GENERAL QUALITY AND STANDARDS: To facilitate rapid examination, the detailed specifications concerning basic requirements for labor, materials, equipment and/or incidentals to be used on the project are included under the various divisions in as brief a form as is consistent with clarity. The primary concern of the detailed specifications is for standards of performance expected for the finished work.

The interests of the Owner, the General Contractor and others concerned with the work require the inclusion of certain general governing requirements and standards, as a precaution against contingency and to provide for the conditions under which the construction and the administration of the work will be carried out.

General requirements for the quality of the work, when not otherwise covered in more specific detail in the specifications, will be governed by certain trade standards as described in this section on "Standards and Quality Control."

These specifications consider the project as a whole and assume its completion under a general contract except where specific arrangements are made for the Owner to purchase certain materials and equipment directly. The scope of subcontracts and the quantities of materials and labor supplied to the General Contractor by others are assumed to be matters governed by agreement between the General Contractor and his subcontractors and suppliers and not by agreement between the Owner and any subcontractor or supplier.

Various sections of the construction specifications are intended to govern only the quality of work and/or materials incidental to the particular branch of work mentioned in the section title. Sections are not intended as itemizations of the work or materials to be furnished or to limit or define the scope of any subcontract or agreement to furnish material and labor.

The organization of the specifications is for convenience only, and such organization implies no assumption by the Architect of the responsibility of arbitrator in establishing subcontract limits or in allotting portions of the work to various subcontractors.

The furnishing of all items of material, labor, equipment and/or incidentals necessary to the completion of the project as a whole will be expected when such items are called for on the drawings by diagram, note or schedule; are listed in the specifications; or are reasonably inferred by either or a combination of both.

RESPONSIBILITIES FOR TESTING:

CONTRACTOR RESPONSIBILITIES: Notwithstanding other sections of this specification, the Owner will not pay for testing. Except where testing is specifically indicated to be provided by another identified entity, inspections, tests and similar quality control services are the Contractor's responsibility; these services also include those specified to be performed by an independent agency and not directly by the Contractor. Costs for these services shall be included in the Contract Sum. The Contractor shall employ and pay an independent agency, testing laboratory or other qualified firm to perform quality control services specified.

RETEST RESPONSIBILITY: Where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance of related work with the requirements of the contract documents, then retests are the responsibility of the Contractor, regardless of

whether or not the original test was the Contractor's responsibility. Retesting of work revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original work.

QUALIFICATION FOR TESTING AND INSPECTIONS: Except as otherwise indicated, engage inspection and test service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which are recognized in the industry as specialized in the types of inspections and tests to be performed.

REPORT DATA: Written reports of each inspection, test or similar service shall include, but not be limited to the following:

- Name of testing agency or test laboratory.
- Dates and locations of samples and tests or inspections.
- Names of individuals making the inspection or test.
- Designation of the work and test method.
- Complete inspection or test data.
- Test results.
- Interpretations of test results.
- Notation of significant ambient conditions at the time of sample-taking and testing.
- Comments or professional opinion as to whether inspected or tested work complies with requirements of the contract documents.
- Recommendations on retesting, if applicable.

TESTING: The Architect shall designate the tests which shall be made, and the Contractor shall not obligate the Owner for tests without the Architect's approval.

A. TESTING COSTS PAID FOR BY THE CONTRACTOR: Certain tests of materials, equipment and systems are required as part of the contract and shall be paid for by the Contractor. These are specifically named in the technical specifications, and the types of tests are as follows:

- (1) Where tests are required by the technical specifications for materials, methods or equipment, the Contractor shall pay the cost of INITIAL tests to prove qualities and determine conformance with specification requirements, e.g., mill tests on cement and steel; load testing of piling; sieve analysis and colorimetric tests on sand; strength test for determining proportions of materials for concrete; moisture content and sound transmission tests of concrete blocks; design mix for asphaltic concrete; etc.
- (2) If substitute materials or equipment are proposed by the Contractor, he shall pay the cost of ALL TESTS which may be necessary to satisfy the Architect that specification requirements are met.
- (3) If materials or workmanship are used which fail to meet specification requirements, the Contractor shall pay the cost of all coring or other tests deemed necessary by the Architect to determine the safety or suitability of the material or element.
- (4) The Contractor shall pay for all testing costs, including, but not limited to, power, fuel and equipment cost, which may be required for complete testing of all equipment and systems for proper operation, such as plumbing and electrical.

- (5) The Contractor shall arrange and pay for tests to confirm compliance of materials and procedures with initial tests and specifications. Examples of such tests include compressive tests of concrete and concrete block, Proctor and compaction tests of fill material and earthwork. Detailed requirements for such tests are outlined under the section of the specifications pertaining to that phase of the work.

2.0 - PRODUCTS (Not Applicable).

3.0 - EXECUTION

REPAIR AND PROTECTION:

GENERAL: Upon completion of inspection, testing, sample-taking and similar services performed on the work, repair damaged work and restore substrates and finishes to eliminate deficiencies, including deficiencies in the visual qualities of exposed finishes. Comply with the contract document requirements for "Cutting and Patching". Protect work exposed by or for quality control service activities, and protect repaired work. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 01400

SECTION 01500 - TEMPORARY FACILITIES

1.0 - GENERAL

RELATED DOCUMENTS: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to the work of this section.

DESCRIPTION OF REQUIREMENTS: This section specifies administrative and procedural requirements for temporary services and facilities, including such items as temporary utility services, temporary construction and support facilities, and project security and protection.

USE CHARGES: No cost or usage charges for temporary services or facilities are chargeable to the Owner or Architect/Engineer. Cost or use charges for temporary services or facilities will not be accepted as a basis of claims for a change-order extra.

Impact fees and front foot charges for sewer and water connections are not to be included under this contract.

TEMPORARY UTILITY SERVICES: Required for use at the project site include but are not limited to the following:

- Water service and distribution.
- Temporary electric power and light.
- Telephone service.
- Storm and sanitary sewer.

Provide adequate utility capacity at each stage of construction. Prior to availability of temporary utilities at the site, provide trucked-in services for start-up of construction operations.

Obtain and pay for temporary easements required to bring temporary utilities to the project site, where the Owner's permanent easement cannot be utilized for that purpose.

TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES: Required for the project include but are not limited to the following:

- Temporary heat.
- Field offices and storage sheds.
- Temporary roads and paving.
- Sanitary facilities, including drinking water.
- Dewatering facilities and drains.
- Temporary enclosures.
- Hoists and temporary elevator use.
- First aid station.
- Project identification, bulletin boards and signs.
- Waste disposal services.
- Rodent and pest control.
- Construction aids and miscellaneous general services and facilities.

Alternate temporary services and facilities, equivalent to those specified, may be used, subject to acceptance by the Architect/Engineer.

SECURITY AND PROTECTION FACILITIES AND SERVICES: Required for the project include but are not limited to the following:

- Temporary fire protection.
- Barricades, warning signs, lights.
- Sidewalk bridge or enclosure fence for the site.
- Environmental protection.

Alternate security and protection methods or facilities, equivalent to those specified, may be used, subject to acceptance by the Architect/Engineer.

QUALITY ASSURANCE:

REGULATIONS: Comply with requirements of local laws and regulations governing construction and local industry standards, in the installation and maintenance of temporary services and facilities, including but not limited to the following:

- Building Codes, including local requirements for permits, testing and inspection.
- Health and safety regulations.
- Utility company regulations and recommendations governing temporary utility services.
- Police and Fire Department rules and recommendations.
- Environmental protection regulations governing use of water and energy, and the control of dust, noise and other nuisances.

In addition, comply with "Environmental Impact" commitments the Owner or previous Owners of the site may have made to secure approval to proceed with construction of the project.

STANDARDS: Comply with the requirements of NFPA Code 241, "Building Construction and Demolition Operations", the ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and the NECA National Joint Guideline NJG-6 "Temporary Job Utilities and Services".

INSPECTIONS: Inspect and test each service before placing temporary utilities in use. Arrange for required inspections and tests by governing authorities, and obtain required certifications and permits for use.

JOB CONDITIONS:

GENERAL: Provide each temporary service and facility ready for use at each location when the service or facility is first needed to avoid delay in performance of the work. Maintain, expand as required and modify temporary services and facilities as needed throughout the progress of the Work. Do not remove until services or facilities are no longer needed, or are replaced by the authorized use of completed permanent facilities.

With the establishment of the job progress schedule, establish a schedule for the implementation and termination of service for each temporary utility. At the earliest

feasible time, and when acceptable to the Owner and Architect/Engineer, change over from the use of temporary utility service to the use of the permanent service, to enable removal of the temporary utility and to eliminate possible interference with completion of the work. Contractor will be responsible for all utility costs until final acceptance or occupancy, whichever comes earliest.

CONDITIONS OF USE: Operate temporary services and facilities in a safe and efficient manner. Do not overload temporary services or facilities, and do not permit their interference with the progress of the work. Do not allow unsanitary conditions, public nuisances or hazardous conditions to develop or persist on the site.

TEMPORARY UTILITIES: Do not permit the freezing of pipes, flooding or the contamination of water sources.

TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES: Maintain temporary facilities in a manner to prevent discomfort to users. Take necessary fire prevention measures. Maintain temporary support facilities in a sanitary manner to avoid health problems and other deleterious effects.

SECURITY AND PROTECTION: Maintain site security and protection facilities in a safe, lawful and publicly acceptable manner. Take necessary measures to prevent erosion of the site.

2.0 - PRODUCTS

MATERIALS AND EQUIPMENT:

GENERAL: Provide new materials and equipment for temporary services and facilities; used materials and equipment that are undamaged and in serviceable condition may be used, if acceptable to the Architect/Engineer. Provide only materials and equipment that are recognized as being suitable for the intended use, by compliance with appropriate standards.

TEMPORARY UTILITIES: Where the local utility company provides only a portion of the temporary utility, provide the remainder with matching, compatible materials and equipment. Comply with the utility company's recommendations.

ELECTRICAL SERVICE: Comply with applicable NEMA, NECA and UL standards and governing regulations for materials and layout of temporary electric service, including those requirements included in Division-16 sections.

VOLTAGE DIFFERENCES: Provide identification warning signs at power outlets which are other than 110-120 volt power. Provide polarized outlets for plug-in type outlets, to prevent insertion of 110-120 volt plugs into higher voltage outlets.

GROUND-FAULT PROTECTION: Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for plug-in connection of power tools and equipment.

ELECTRICAL POWER CORDS: Use only grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Use single lengths or use

waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas of work.

LAMPS AND LIGHT FIXTURES: Provide general service incandescent lamps of wattage indicated or required for adequate illumination. Protect lamps with guard cages or tempered glass enclosures, where fixtures are exposed to breakage by construction operations. Provide exterior fixtures where fixtures are exposed to the weather or moisture.

TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES: Provide facilities that can be maintained properly throughout their use at the project site.

TEMPORARY OFFICES AND SIMILAR CONSTRUCTION: For temporary offices, fabrication shops, storage sheds and similar construction, provide either standard prefabricated or mobile units or the equivalent job-built construction. Provide insulated, weather tight units, heated or air-conditioned where indicated, lockable entrances, operable windows, roofing, foundations adequate for normal loading, including wind loads, serviceable finishes, and mechanical and electrical equipment necessary to achieve ambient conditions indicated.

SELF-CONTAINED TOILET UNITS: Provide single-occupant self-contained toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar non-absorbent material.

FIRST AID SUPPLIES: Comply with governing regulations and recognized recommendations within the construction industry.

DRINKING WATER: Provide potable water approved by local health authorities. Where well water must be used, comply with local health authorities recommendations for type and frequency of testing water for potability.

SIGN MATERIALS: For signs and directory boards, provide exterior type, Grade B-B High Density Concrete Form Overlay Plywood conforming to PS-1, of sizes and thicknesses indicated. Provide exterior grade acrylic-latex-base enamel for painting panels and applying graphics.

SECURITY AND PROTECTION FACILITIES:

FIRE EXTINGUISHERS: Provide type "A" fire extinguishers for temporary offices and similar spaces where there is minimal danger of electrical or grease-oil-flammable liquid fires. In other locations provide type "ABC" dry chemical extinguishers, or a combination of several extinguishers of NFPA recommended types for the exposures in each case.

PLYWOOD: For fences and vision barriers, provide exterior type, minimum 3/8" thick plywood, prime and finish painted. For safety barriers, sidewalk bridges and similar direct-contact uses, provide minimum 5/8" thick exterior plywood, prime and finish painted.

OPEN-MESH FENCING: Provide No. 11-gage galvanized chain link fabric fencing 6 feet high with galvanized barbed wire top strand and galvanized steel pipe posts, 1-1/2" I.D. for line posts, and 2-1/2" I.D. for corner posts.

WIRE FENCING: Provide 4-ft. high woven wire fence or welded wire mesh fencing supported by 6-ft. long, 4-in. round or square wood posts set 2 feet in ground and spaced not greater than 12 feet o.c.

3.0 - EXECUTION

INSTALLATION, GENERAL:

GENERAL: Use qualified tradesmen for installation of temporary services and facilities. Locate temporary services and facilities where they will serve the entire project adequately and result in minimum interference with the performance of the Work.

Relocate, modify and extend services and facilities as required during the course of work to accommodate the entire work of the project.

TEMPORARY UTILITY INSTALLATION:

GENERAL: Engage the local utility company to install temporary service to the project, or to make connections to existing service. Arrange with the companies and existing users for an acceptable time when service can be interrupted, where necessary, to make connections for temporary services.

WATER SERVICE:

GENERAL: Install water service and distribution piping of sizes and pressures adequate for construction purposes during the construction period and until permanent service is in use.

Obtain water service from the nearby water main of the local water authority, as permitted by the governing authority. Pay water service use charges, whether metered or otherwise, for all water used by entities authorized to be at or to perform work at the project site. Exercise control over usage in an effort to conserve water.

TEMPORARY ELECTRIC POWER SERVICE:

GENERAL: Provide a weatherproof, grounded temporary electric power service and distribution system of sufficient size, capacity, and power characteristics to accommodate performance of work during the construction period. Whenever an overhead floor or roof deck has been installed, install temporary lighting adequate to provide sufficient illumination for safe work and traffic conditions in every area of work.

TEMPORARY SERVICE: Install service and grounding in compliance with the National Electric Code (NFPA 70). Include necessary meters, transformers, overload protected disconnect and main distribution switch gear.

Connect temporary service to the local electric power company main in the manner directed by company officials. Pay use charges, whether metered or otherwise, for electricity used by all entities authorized to be at or to perform the work at the project site. Exercise control over power usage in an effort to conserve energy.

POWER DISTRIBUTION SYSTEM: Provide circuits of adequate size and proper characteristics for each use. In general run wiring overhead, and rise vertically where wiring will be least exposed to damage from construction operations. Provide rigid steel conduit or equivalent raceways for wiring which must be exposed on grade, floors, decks or other areas of possible damage or abuse.

TEMPORARY LIGHTING:

Provide local switching of temporary lighting, spaced to allow lighting to be turned off in patterns to conserve energy and retain light suitable for work-in-progress, access traffic, security check and project lock-up.

Install and operate temporary lighting that will provide adequate illumination for general construction and fulfill security and protection requirements, without the necessity of operating the entire temporary lighting system.

TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION:

GENERAL: Provide a reasonably neat and uniform appearance in temporary construction and support facilities acceptable to the Architect/Engineer and the Owner.

Locate field offices, storage and fabrication sheds and other support facilities for easy access to the Work. Position offices so that windows give the best possible view of construction activities.

Except as otherwise indicated, make the change-over from use of temporary services and facilities to use of permanent services and facilities at the earliest feasible date at each portion of the building, to minimize hazards and interferences with performance of the Work.

Maintain field offices, storage and fabrication sheds, temporary sanitary facilities, waste collection and disposal systems, and project identification and temporary signs until near substantial completion. Immediately prior to substantial completion remove these facilities. Personnel remaining at the site beyond substantial completion will be permitted to use certain permanent facilities, under restricted use conditions acceptable to the Owner.

TEMPORARY HEAT:

GENERAL: Provide temporary heat where indicated or needed for performance of the Work, curing or drying of recently installed work or protection of work in place from adverse effects of low temperatures or high humidity. Select facilities known to be safe and without deleterious effect upon the work in place or being installed. Coordinate with ventilation requirements to produce the indicated ambient condition required and to minimize the consumption of fuel or energy.

FIELD OFFICES:

CONTRACTOR'S FIELD OFFICE AND STORAGE SHEDS: The Contractor shall construct or provide a field office and temporary storage sheds as required for his needs. The

construction shall be of adequate structural design not to constitute a safety hazard and shall comply with all local ordinances and regulations. The structures are to be neat in appearance and so maintained during the entire construction time. This requirement applies to all temporary facilities constructed by subcontractors. Erect sheds or enclosed protection to properly protect any materials stored on the site.

DEWATERING AND TEMPORARY DRAINAGE: Provide dewatering and/or drainage, to prevent surface water and subsurface or ground water from flooding into excavations and to prevent water from flooding the project site and the surrounding area. Do not allow water to accumulate in excavations. Remove water from excavations, using dewatering methods which will prevent the softening of foundation bottoms, undercutting footings and soil changes detrimental to the stability of subgrades and foundations. Provide and maintain pumps, sumps, suction and discharge lines and other dewatering system components necessary to convey water away from excavations. Divert surface water from excavations; and maintain ground water at least 1'-6" below bottoms of excavations until foundations, waterproofing and basement floor slabs and walls are in place and cured. Boring logs, on file in the Architect/Engineer's office, indicate the elevation of ground water at the time of the borings, but seasonal variations must be anticipated. Comply with all pollution control regulations.

PROJECT SIGN: Erect a sign in a prominent location on the site, identifying the project and containing the following information:

- Name of Project
- Names of Board or Owner
- Architect/Engineer's Name
- Prime Contractor's Name and Address

The sign shall be 4' x 8' of 3/4" exterior grade plywood, supported on 4x4 treated wood posts and framed with 2x4's. The Architect/Engineer will furnish the design and lettering layout. Painting shall be by a professional sign painter, using durable sign paint.

END OF SECTION 01500

SECTION 01770 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Warranties.
 - 3. Final cleaning.
- B. Related Sections include the following:
 - 1. Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
 - 2. Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial 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. See 1.9 Warranties for specific requirements.
 - 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. Deliver tools, spare parts, extra materials, keys, special wrenches and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable. Obtain dated and signed receipt from Owner for delivery of these items and place in the closeout document binder.
 - 6. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 7. Complete startup testing of systems.

8. Submit test/adjust/balance records.
9. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
10. Advise Owner of changeover in heat and other utilities.
11. See 3.1 Cleaning.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Construction Manager of unfulfilled requirements. Architect will prepare the Certificate of Substantial 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.

1.4 MAINTENANCE AND OPERATING MANUALS SUBMITTALS

A. The Contractor shall be responsible for collecting, identifying, indexing and collating the following materials from the subcontractors and will deliver three copies of the finished document to the Architect/ Engineer for checking of correctness.

1. Complete equipment diagrams, operating instructions, maintenance manuals, parts lists, wiring diagrams, pneumatic and/or electrical control diagrams, test and balance reports, inspection reports, guarantees and warranties, as applicable, for each and every piece of fixed equipment furnished under this contract, to be supplied in a ring binder, hard-cover book, properly indexed for ready reference
2. Specific information regarding manufacturers' names and addresses; nearest distributors' and service representatives' names, addresses, office and home phone numbers; make and model numbers; operating design and characteristics; etc.
3. Provide any additional data as called for in the detailed technical specifications.
4. All information submitted shall be updated to reflect existing conditions.

1.5 GENERAL OPERATING AND MAINTENANCE INSTRUCTIONS

A. Arrange for each installer of operating equipment and other work that requires regular or continuing maintenance, to meet at the site with the Owner's personnel to provide necessary basic instruction in the proper operation and maintenance of the entire Work. Where installers are not experienced in the required procedures, include instruction by the manufacturer's representatives. This instruction will include normal start-up, run, stop and emergency operations, location and operation of all controls, alarms and alarm systems, etc. The instruction will include tracing the system in the field and on the diagrams in the instruction booklets, so that operating personnel will be thoroughly familiar with both the system and the data supplied.

1.6 RECORD DOCUMENT SUBMITTALS

- A. General: Specific requirements for record documents are indicated in the individual sections of these specifications. General submittal requirements are indicated in the various sections of the specifications, including the section on "Shop Drawings."
1. Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Owner's reference during normal working hours.
- B. Record Drawings: Maintain a record set of blue or black line whiteprints of contract drawings and shop drawings in a clean, undamaged condition. Mark-up the set of record documents to show the actual installation where the installed work varies substantially from the work as originally shown. Mark whichever drawing is most capable of showing the actual "field" condition fully and accurately; however, where shop drawings are used for mark-up; record a cross-reference at the corresponding location on the contract drawings. Give particular attention to concealed work that would be difficult to measure and record at a later date.
1. Mark record sets with red erasable pencil and, where feasible, use other colors to distinguish between variations in separate categories of work.
 2. Mark-up new information, which is known to be important to the Owner, but for some reason was not shown on either contract drawings or shop drawings. Record the exact locations, as installed, of all underground and otherwise concealed conduit, pipe, and equipment, which were not installed exactly as shown on the contract drawings. Pipe lines and conduit which are installed in furred spaces, pipe chases or other spaces, which can be readily inspected by the use of access panels or other means of access, will not be considered as being concealed. With reference to electrical work, the exact runs of concealed conduit shall be shown on these drawings. Submit these mark-up's to the Architect/Engineer for their review and approval before making the final changes.
 3. Once the A/E has approved the mark-ups, the Contractor shall have this data recorded to scale by a competent draftsman and provide the Architect with reproducible drawings and CAD files no later than 30 days after substantial completion. Each sheet shall bear the date and name of the Contractor.
ALL COSTS ASSOCIATED WITH PREPARING THE RECORD DRAWINGS IS BORNE BY THE CONTRACTOR.

1.7 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 1 Section "Payment Procedures."
 2. Submit certified copy of Architect's Substantial 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
 6. Submit Consent of Surety, if applicable.
 7. Submit Certificate for use for elevator certified by State Elevator Inspector, if applicable.
- 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.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit one copy 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.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.

1.9 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 Substantial Completion is indicated.
- B. Partial Occupancy: Submit properly executed warranties within 30 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 (215-by-280-mm) 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 CLEANING

- A. General: Provide 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 cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. 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.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.

- f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - n. Replace parts subject to unusual operating conditions.
 - o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - q. Clean ducts, blowers, and coils if units were operated without filters during construction.
 - r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. 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.
 - s. Leave Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.
- D. 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 01770

SECTION 02221 - BUILDING DEMOLITION

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. Demolition and removal of buildings and site improvements.
 - 2. Abandoning in-place below-grade construction.
 - 3. Disconnecting, capping or sealing, and abandoning in-place site utilities.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 INFORMATIONAL SUBMITTALS

- A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

1.7 PROJECT CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
- B. Owner assumes no responsibility for buildings and structures to be demolished.
 - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
- D. On-site storage or sale of removed items or materials is not permitted.

PART 2 - PRODUCTS[(Not Used)]

2.1 SOIL MATERIALS

- A. Satisfactory Soils: Comply with requirements in Section 02300 "Earthwork."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.

3.2 PREPARATION

- A. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.
 - 1. Arrange to shut off indicated utilities with utility companies.
 - 2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
 - 3. Cut off pipe or conduit a minimum of 12 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
- B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of demolition.

3.3 PROTECTION

- A. Existing Facilities: Protect adjacent areas and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.
 - 1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
- C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
 - 1. Protect adjacent buildings and facilities from damage due to demolition activities.
 - 2. Protect existing site improvements, appurtenances, and landscaping to remain.
 - 3. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 4. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
 - 5. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
- D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.4 DEMOLITION, GENERAL

- A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
 - 2. Maintain fire watch during and for at least two hours after flame cutting operations.
 - 3. Maintain adequate ventilation when using cutting torches.
 - 4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Site Access and Temporary Controls: Conduct building 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 authorities having jurisdiction.

2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

- C. Explosives: Use of explosives is not permitted.

3.5 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level.
- B. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
 1. Remove below-grade construction, foundation walls, and footings, completely to a depth of 1 foot below grade.
- C. Existing Utilities: Abandon existing utilities and below-grade utility structures.

3.6 SITE RESTORATION

- A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Section 02300 "Earthwork."
- B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.7 REPAIRS

- A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and legally dispose of them in an approved landfill acceptable to authorities having jurisdiction.
 1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Do not burn demolished materials.

3.9 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.
 - 1. Clean roadways of debris caused by debris transport.

END OF SECTION 02221

SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preparing subgrades for slabs-on-grade, walks and lawns and grasses.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Subgrade course for concrete walks.
 - 4. Subsurface drainage backfill for walls and trenches.
 - 5. Excavating and backfilling for utility trenches.
 - 6. Excavating and backfilling trenches for buried mechanical and electrical utilities.
- B. Related Sections include the following:
 - 1. Divisions 2, 15, and 16 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

1.3 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: Course placed between the subgrade course and paving.
- C. Bedding Course: Course 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. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect or Engineer. 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 (3 m) in width and pits more than 30 feet (9 m) in either length or width.
 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect or Engineer. Unauthorized excavation, as well as remedial work directed by Architect or Engineer, shall be without additional compensation.
- F. Fill: Soil materials used to raise existing grades.
- G. 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.
- H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- I. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- J. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by an independent geotechnical testing agency, according to ASTM D 1586.
- K. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

1.4 SUBMITTALS

- A. Product Data: For the following:
1. Each type of plastic warning tape.
- B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
 2. Laboratory compaction curve according to ASTM D 1557 for each on-site or borrow soil material proposed for fill and backfill.

1.5 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

1.6 SAFETY

- A. The contractor shall be responsible for making all excavations in a safe manner. Provide appropriate measures to retain excavation side-slopes to ensure that persons working in or near excavations are protected.
- B. All trench excavations, which exceed five (5) feet in depth, or greater shall be done in accordance with OSHA Standard 29 CFR, Section 1926.650 Subpart P. Contractor shall provide written documentation of compliance to the Architect or Engineer. Contractor shall provide a separate cost item within his schedule of values indicating cost of compliance. Contractor shall also be responsible for design of trench safety systems.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
 - 1. Borrow soil material should contain less than ten (10) percent passing the No. 200 sieve.
- B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory 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 2 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 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) 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 (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) 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 (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) 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 (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- H. 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 (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.
- I. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; 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 earthwork operations.

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.
 - 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3. Groundwater table to be maintained at a minimum of two (2) feet below all earthwork surfaces.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 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 indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
 - b. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - c. 6 inches (150 mm) beneath bottom of concrete slabs on grade.
 - d. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.
 3. Strip the proposed construction limits of all grass, roots, topsoil, construction debris, pavement and other deleterious materials within and ten (10) feet beyond perimeter of the proposed building and in all paved areas. Expect cleaning and grubbing to depths of twelve (12) inches. Deeper clearing and grubbing may be encountered in heavily vegetated areas where major root systems are encountered.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). 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. 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 (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 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 (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: 12 inches (300 mm) 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 (150 mm) in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - 2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 - 3. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and 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 (5 km/h).
 - 2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
 - 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.

- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 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 (17.2 MPa), may be used when approved by Architect.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.10 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.

3.11 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.

3.12 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. Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section "Cast-in-Place Concrete."
- D. Provide 4-inch (100-mm) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase.
- E. Place and compact initial backfill of subbase material, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the utility pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- G. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- H. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.13 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 satisfactory soil material.
 - 3. Under building slabs, use engineered fill.
 - 4. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 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 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 12 inches (300 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) 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 1557:
 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent of the Modified Proctor.
 2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) 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 90 percent.

3.16 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 Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Lawn or Unpaved Areas: Plus or minus 1 inch (25 mm).
 2. Walks: Plus or minus 1 inch (25 mm).
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.17 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork 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 when approved by Architect.
- 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. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three (3) tests.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least one (1) test for each 100 feet (30 m) or less of wall length, but no fewer than two (2) tests.
 - 3. Trench Backfill: At each compacted initial and final backfill layer, at least one (1) test for each 150 feet (46 m) or less of trench length, but no fewer than two (2) tests.
- 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 to depth required; recompact and retest until specified compaction is obtained.

3.18 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.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 02300

SECTION 02361 - TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following for termite control:
 - 1. Soil treatment.

1.3 DEFINITIONS

- A. EPA: Environmental Protection Agency
- B. PCO: Pest control operator.

1.4 SUBMITTALS

- A. Product Data: Treatments and application instructions, including EPA-Registered Label. Provide Material Safety Data Sheet (MSDS) forms on jobsite during application of soil treatment.
- B. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.
- C. 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.
- D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Brand name and manufacturer of termiticide.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes, and rates of application used.
 - 6. Areas of application.
 - 7. Water source for application.

- E. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: A PCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this project and whose work has a record of successful in-service performance.
- B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

1.6 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 and requirements of authorities having jurisdiction.

1.7 COORDINATION

- A. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.8 WARRANTY

- A. 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 complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and is formulated to prevent termite infestation. Use only soil treatments that are not harmful to plants. 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. Chloropyrifos ("Dursban TC"); 1.0 percent in water emulsion or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.
 1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation of substrate 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, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with 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

termite barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade: 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, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
 3. Masonry: Treat voids.
 4. 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 termite 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 02361

SECTION 02821 - CHAIN-LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Chain-Link Fences: Industrial.
 - 2. Gates: Swing.
- B. Related Sections include the following:
 - 1. Division 2 Section "Earthwork" for site excavation, fill, and backfill where chain-link fences and gates are located.
 - 2. Division 3 Section "Cast-in-Place Concrete" for concrete post concrete fill.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.
 - 1. Fence and gate posts, rails, and fittings.
 - 2. Chain-link fabric, reinforcements, and attachments.
 - 3. Gates and hardware.
- B. Shop Drawings: Show locations of fences, gates, posts, rails, tension wires, details of extended posts, extension arms, gate swing, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.
- C. Product Certificates: For each type of chain-link fence, and gate, signed by product manufacturer.
 - 1. Strength test results for framing according to ASTM F 1043.
- D. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
 - 1. Engineering Responsibility: Preparation of data for chain-link fences and gates, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.
- B. Interruption of Existing Utility Service: Do not interrupt utility services to 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 Architect no fewer than two days in advance of proposed interruption of utility services.
 - 2. Do not proceed with interruption of utility services without Architect's written permission.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Heights as indicated on drawings. Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle. Comply with ASTM A 392, CLFMI CLF 2445, and requirements indicated below:
 - 1. Steel Wire Fabric: Metallic-coated wire with a diameter of 0.148 inch (3.76 mm).
 - a. Mesh Size: 2 inch (50 mm).
 - b. Weight of Metallic (Zinc) Coating: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. (366 g/sq. m) with zinc coating applied after weaving.
 - c. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
 - 2. Polymer-coated Fabric: ASTM F 668, Class 2b over metallic-coated steel wire.
 - a. Color: Black, complying with ASTM F 934.

3. Selvage: Knuckled at both selvages.

2.2 INDUSTRIAL FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, ASTM F 1083 for Group IC round pipe, and the following:
 1. Group: IA, round steel pipe, Schedule 40.
 2. Fence Height: 6 feet (1.83 m).
 3. Strength Requirement: Light industrial according to ASTM F 1043.
 4. Post Diameter and Thickness: According to ASTM F 1083.
 - a. Top Rail: 1.66 inches (42 mm).
 - b. Line Post: 2.375 inches (60 mm).
 - c. End, Corner and Pull Post: 2.875 inches (73 mm).
 - d. Swing Gate Post: According to ASTM F 900.

2.3 TENSION WIRE

- A. General: Provide horizontal tension wire at the following locations:
 1. Location: Extended along bottom of fence fabric.
- B. Metallic-Coated Steel Wire: 0.177-inch- (4.5-mm-) diameter, marcelled tension wire complying with ASTM A 817, ASTM A 824, and the following:
 1. Metallic Coating: Type II, zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:
 - a. Matching chain-link fabric coating weight.

2.4 INDUSTRIAL SWING GATES

- A. General: Comply with ASTM F 900 for double swing gate types.
 1. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1043 and ASTM F 1083 for materials and protective coatings.
- B. Frames and Bracing: Fabricate members from round, galvanized steel tubing with outside dimension and weight according to ASTM F 900 and the following:
 1. Gate Fabric Height: 2 inches (50 mm) less than adjacent fence height.
 2. Leaf Width: 8 feet and 11 feet, see Civil Engineering drawings for gate sizes and locations.
 3. Frame Members:
 - a. Tubular Steel: 1.66 inches (42 mm) round.

C. Frame Corner Construction:

1. Welded or assembled with corner fittings.

D. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet (1.52 m) wide. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

2.5 FITTINGS

A. General: Comply with ASTM F 626.

B. Post and Line Caps: Provide for each post.

1. Line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: Attach rails securely to each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches (152 mm) long.
2. Rail Clamps: Line and corner boulevard clamps for connecting rails in the fence line-to-line posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches (50 mm) shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment, as required.

H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
 - a. Hot-Dip Galvanized Steel: 0.106-inch- (2.69-mm-); galvanized coating thickness matching coating thickness of chain-link fence fabric.

2.6 POLYMER FINISHES

A. Supplemental Color Coating: In addition to specified metallic coatings for steel, provide fence components with polymer coating.

B. Metallic-Coated Steel Tension Wire: PVC-coated wire complying with ASTM F 1664, Class 2b.

- C. Metallic-Coated Steel Framing and Fittings: Comply with ASTM F 626 and ASTM F 1043 for polymer coating applied to exterior surfaces and, except inside cap shapes, to exposed interior surfaces.
 - 1. Polymer Coating: Not less than 10-mil- (0.254-mm-) thick PVC finish.
- D. Color: Match chain-link fabric, complying with ASTM F 934.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.
 - 1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.
 - 1. Install fencing on established boundary lines inside property line, as this applies to the relocation of existing fence.

3.4 CHAIN-LINK FENCE INSTALLATION

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

- a. Concealed Concrete: Top 2 inches (50 mm) below grade to allow covering with surface material.
- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more as indicated on Drawings.
- D. Line Posts: Space line posts uniformly at 10 feet (3 m) o.c.
- E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts.
 - 1. Locate horizontal braces at midheight of fabric 6 feet (1.83 m) or higher, on fences with top rail and at 2/3 fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- (3.05-mm-) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) o.c. Install tension wire in locations indicated before stretching fabric.
 - 1. Bottom Tension Wire: Install tension wire within 6 inches (150 mm) of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches (50 mm) between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches (380 mm) o.c.
- J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at 1 end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 inches (300 mm) o.c. and to braces at 24 inches (610 mm) o.c.
- K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.5 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.6 ADJUSTING

- A. Gate: Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

END OF SECTION 02821

SECTION 02940 - BSS 300 EMBEDDED SYNTHETIC TRACK SURFACING SYSTEM**PART 1 – GENERAL****1.1 SCOPE**

- A. The synthetic surfacing contractor shall furnish all labor, materials, equipment, supervision and services necessary for the proper completion of the BSS 300 Synthetic Track Surfacing System and related work indicated on the drawings and specified herein.

The synthetic surfacing contractor shall refer to the drawings for the required locations of synthetic track surfacing to be installed. All quantities and dimensions shall be field verified by the synthetic surfacing contractor.

1.2 SPECIFIC SCOPE OF WORK

- A. Install an IAAF approved, impermeable polyurethane synthetic track system consisting of SBR Rubber and BEYPUR, a single-component polyurethane binder and BEYPUR, a poured-in-place, two-component U.V. stabilized elastomeric polyurethane wearing layer with an embedded textured finish.
- B. Layout and paint all track lines and event markings as required and specified by current IAAF and NCAA rules.

1.3 COORDINATION

- A. The synthetic surfacing contractor shall coordinate the work specified with an authorized and appointed representative of the owner so as to perform the work during a period and in a manner acceptable to the owner.

PART 2 – CODES AND STANDARDS**2.1 APPLICABLE PUBLICATIONS**

- A. Codes and standards follow the current guidelines set forth by the International Amateur Athletic Federation (IAAF) and the National Collegiate Athletic Association (NCAA), along with the current material testing guidelines as published by the American Society of Testing and Materials (ASTM).

2.2 PERFORMANCE STANDARDS

- A. The BSS 300 synthetic track surfacing system shall exhibit the following minimum performance standards as required by IAAF:

- | | |
|-----------------------------|---------------------------|
| 1. Thickness: | (12-13mm) or as specified |
| 2. Force Reduction | 35-50% |
| 3. Vertical Deformation: | 0.6mm-2.5mm |
| 4. Coefficient of Friction: | ≥ 0.5 (47 TRRL Scale) |
| 5. Tensile Strength: | ≥ 0.5 Mpa |
| 6. Elongation: | ≥ 40% |

PART 3 – QUALITY ASSURANCE

3.1 CONTRACTOR AND MANUFACTURER QUALIFICATIONS

- A. The CONTRACTOR and the MANUFACTURER must be the same.
- B. The CONTRACTOR must have a minimum of 7 years experience in the installation of poured-in-place, two-component elastomeric polyurethane synthetic track surfacing.
- C. The CONTRACTOR shall be able to furnish evidence that they have been in business for a period of not less than 3 years, under the present name, and if required, furnish financial statements for each of the past 3 years.
- D. The CONTRACTOR must have installed a minimum of 6 outdoor track facilities in the last 2 years using the exact, IAAF certified, poured-in-place, two-component elastomeric polyurethane synthetic track surfacing, as specified herein with the contractor bidding this project.
- E. The MANUFACTURER must have a minimum of 10 years of experience with compound two-part polyurethane for athletic surfaces.
- F. The CONTRACTOR is required to provide documentation that shows the selected specified and installed product meets IAAF Performance Specification for Synthetic Surfaced Athletics Tracks (Outdoor) and is certified in terms of the IAAF certification system as updated to present day.
- G. CONTRACTOR is to provide a list of completed facilities, minimum of 10 which are certified to meet IAAF/NCAA rules & regulations, utilizing the same product as specified.
- H. The MANUFACTURER must offer a minimum of four (4) IAAF Certified Track Systems.

3.2 SUBMITTALS

- A. The following submittals must be received with the bid submittal:
 - 1. Standard printed specifications of the synthetic track surfacing system to be installed on this project.
 - 2. An affidavit attesting that the synthetic track surfacing material to be installed meets the requirements defined by the manufacturers currently published specifications and any modifications outlined in those technical specifications.
 - 3. A synthetic track surfacing system sample, 6" x 6" in size, of the same synthetic track surfacing system to be installed on this project.
 - 4. An installation list of outdoor track facilities installed within the last two years, using the exact synthetic track surfacing system specified herein.
 - 5. Test results from an approved IAAF Testing Laboratory confirming compliance to the performance of athletic tracks test according to the IAAF.

PART 4 – MATERIALS

4.1 ELASTOMERIC POLYURETHANE

- A. BEYPUR, the two-component U.V. stabilized elastomeric polyurethane compounded from polyol and isocyanate components, based on one hundred percent (100%) Methylene Diphenyl Isocyanate (MDI). No Toluene Diisocyanate Isocyanate (TDI) will be allowed.
- B. The elastomeric polyurethane shall be red in color.

4.2 EPDM GRANULATE

- A. The EPDM granulates shall be approximately 1 to 3mm in
- B. The EPDM granulates and the U.V. stabilized elastomeric polyurethane shall be color matched.

4.3 RUBBER GRANULATE OF THE BASE COURSE

- A. Styrene Butadiene Rubber (SBR) processed ground to a graded size of 1-3mm.
- B. A maximum of 82%, by weight of the paved-in-place base layer, of SBR will be allowed.

4.4 SINGLE COMPONENT POLYURETHANE BINDER

- A. Shall be BEYPUR 300, a single-component polyurethane binder with a long cure time for use in paved mat specifications. A minimum of 18%, by weight of the paved-in-place base layer.

4.5 SEAL COAT

- A. Shall be BEYPUR 200, a two-component polyurethane pore sealer use with paved rubber granule mats. The granular SBR and binder layer shall be sealed with the BEYPUR 200. The application of EPDM dust is not allowed.

4.6 LINE MARKING PAINT

- A. Single-component, moisture cured, aliphatic polyurethane paint.

PART 5 – INSTALLATION

5.1 SUBBASE

- A. The Synthetic Track Surfacing System shall be laid on an approved subbase. The General Contractor shall provide compaction test results of 95% or greater for the installed subbase and asphalt surface.

For NCAA certification the following criteria must be followed. The track surface, i.e. asphalt substrate, shall not vary from planned cross slope by more than + .2%, with a maximum lateral slope outside to inside of 1%, and a maximum slope of 0.1% in any running direction. The finished asphalt shall not vary under a 10' straight edge more than 1/8".

It should be the responsibility of the asphalt-paving contractor to flood the surface immediately after the asphalt is capable of handling traffic, but within 24 hours. If, after 20 minutes of drying time, there are birdbaths evident, it shall be the responsibility of the architect, in conjunction with the surfacing contractor to determine the method of correction. No cold tar patching, skin patching or sand mix patching will be acceptable.

Any oil spills (hydraulic, diesel, motor oil, etc.) must be completely removed, either by chipping out or removing and replacing with new, keyed in asphalt. The minimum depth of any asphalt replacement shall be one inch. The curing time for the asphalt base is 28 days. It shall be the responsibility of the surfacing contractor to determine if the asphalt substrate has cured sufficiently prior to the application of polyurethane surfacing system.

It shall be the responsibility of the general contractor to determine if the asphalt substrate meets all design specifications, i.e. cross slopes, planarity and specific project criteria. After all the above conditions are met, the synthetic surfacing contractor must, in writing, accept the planarity of the asphalt receiving base, before work can commence.

5.2 THICKNESS

- A. The thickness of the BSS 300 Synthetic Track Surfacing System shall be 13mm.

5.3 EQUIPMENT

- A. The BSS 300 Synthetic Track Surfacing System components shall be processed and installed by specially designed machinery and equipment. A mechanically operated paver with variable regulated speed and thermostatically controlled screed shall be used in the installation of the base mat. The wearing course shall be installed using automatic electronic portioning, which provides continuous mixing and feeding for an accurate, quality controlled installation.

5.4 INSTALLATION

- A. Base Course: The SBR granules and BEYPUR 300 shall be mixed together on site to regulate the ratio/quantity of SBR, not to exceed 82% in the base mat portion of the system. The BEYPUR 300 shall be mixed with the SBR rubber so that a minimum of 20%, by weight, exists in the final mixture. This mixture is then mechanically installed using the paver.
- B. Seal Coat: The two BEYPUR 200 components are mixed at the prescribed ratio homogeneously with a suitable mixing device. The coating is squeegee applied to the base mat, making it impermeable.

- C. Wearing Course: The 1 to 3mm EPDM granules shall be integrated into the BEYPUR to achieve the full depth of the 5 mm wearing course. The resilient embedded textured finish shall be a dense matrix of exposed EPDM granules. The homogeneous wearing course shall be applied in situ with the base course.

5.5 SITE CONDITIONS

- A. Installation shall not take place if adjacent or concurrent construction generates excessive dust, abrasives or any other by-product that, in the opinion of the installer, would be harmful to the track material, until completion of such works.
- B. If, in the opinion of the installer of the synthetic material, the weather and/or climatic conditions are detrimental to the proper installation of the surfacing materials, work shall be delayed until conditions are acceptable. Required installation temperature is fifty degrees Fahrenheit and rising. Installation shall be executed only in dry conditions.

PART 6 – LINE STRIPING AND EVENT MARKINGS

6.1 LAYOUT

- A. Line striping and event markings shall be laid out in accordance with current IAAF and NCAA rules.

6.2 CERTIFICATION

- A. Upon completion of the installation, the owner shall be supplied with all necessary computations and drawings as well as a letter of certification attesting to the accuracy of the markings.

PART 7 – GUARANTEE

- A. The BSS 300 Synthetic Track Surfacing System shall be fully guaranteed against faulty workmanship and material failure for a period of five (5) years from the date of acceptance.

Synthetic surfacing material found to be defective as a result of faulty workmanship and/or material failure shall be replaced or repaired at no charge, upon written notification within the guarantee period.

SECTION 02941 - CONSTRUCTION SPECIFICATION RECOMMENDATIONS AND GUIDELINES FOR INSTALLATION OF ASPHALT PAVEMENT WITH STONE BASE UNDER LAYER FOR SYNTHETIC SURFACED RUNNING TRACKS

SECTION 1 – GENERAL

1.1 SCOPE

- 1.1.1 The following specifications are offered as guideline information only in order to assist the Owner and / or Architect or Engineer in the preparation of asphalt and base for the installation of synthetic running track surface. The specifications are general in nature and may require adaptation in order to suit local climatic conditions, expected loads and soil conditions. The synthetic surfacing contractor shall be informed about any proposed specification alteration.

1.2 INTRODUCTION

- 1.2.1 The extremely strict tolerances for gradients and flatness, which are stipulated by the Sport Federations or Associations for the synthetic surfaces, mean that the construction of adequate asphalt and base is of supreme importance. Tolerances are required to be met not only by the newly completed facility, but also over its life, which might be two or three times the expected life of the synthetic surface.

- 1.2.2 The asphalt and base should be designed to meet the following criteria:

- It should be capable of supporting and transmitting to the existing ground the loads of all vehicles, machines and materials to be used in the construction, without causing deformation of the site, or exceeding the ground-bearing capacity;
- It should be capable of supporting and transmitting all the loads on the synthetic surface from athletes and maintenance equipment, without permanent deformation of the asphalt or base;
- It should be sufficiently flexible to provide protection to the synthetic surface from the effects of sub-soil movement and frost heave;
- It should be sufficiently impermeable to provide total protection to the synthetic surface from ground water;
- It should ensure that the above criteria are maintained throughout the life of the installation.

- 1.2.3 The procedure adopted for the construction of a new asphalt base will normally consist in the following operations:

- A comprehensive Geo-technical investigation should be carried out to accurately determine the sub-soil conditions: it is important to ascertain the strata at depths down to approx. 8 feet (2.5m).
- Excavation to remove vegetable matter, soil, loose or frost susceptible material down to firm, load-bearing sub-soil.
- An adequate sub-drain system shall be provided since adequate surface and subsurface drainage is essential for a stable asphalt base.
- Compaction of the sub-soil, graded to falls within the tolerances specified for accuracy of finished level.

- Laying and compacting of ordinary fill to create the sub-base layer (the minimum thickness of the layer to be determined based on the Geo-technical characteristics of the sub-soil and on the expected loads), graded to falls within the tolerances specified for accuracy of finished level and thickness.
- Laying and compacting of 4" - 8" (10 - 20 cm) thick crushed stone to create the base under layer, graded to falls within the tolerances specified for accuracy of finished level, straightness and thickness. Actual specifications for the thickness and composition of the base under layer should be approved by a registered engineer to ensure suitability to local conditions.
- Laying and compacting of minimum 4" (10 cm) thick hot mix asphalt pavement in two layers.
The bottom layer, Asphalt Binder Course, shall be a minimum of 2.5" (60 mm) thick, graded to falls and checked for accuracy of finished level, straightness and thickness within the tolerances specified.
A Tack Coat is applied just prior to placing subsequent pavement layers.
The top layer, Asphalt Top Coat, shall be a minimum of 1.5" (40mm) thick, graded to falls and checked for accuracy of finished level, straightness and thickness within the tolerances specified.

SECTION 2 - PRODUCTS AND MATERIALS

2.1 ORDINARY FILL

- 2.1.1 Ordinary Fill shall be natural soil, well graded and free from all organic or other weak or compressible materials and of any frozen materials. Fill shall contain no stone larger than 4" (10 cm) in any dimensions.
- 2.1.2 It shall be of such nature and character that it can be dried and compacted in a reasonable length of time which shall not unduly interfere with the progress of construction.
- 2.1.3 It shall be free of all expansive materials such as highly plastic clays, of all materials subject to decay, decomposition or dissolution and of cinders or other unsuitable material.
- 2.1.4 It shall have a maximum dry density of not less than 115 pounds per cubic foot as determined by ASTM D1557, Method-D.

2.2 BASE UNDER LAYER MATERIAL

- 2.2.1 The base under layer material shall be "crushed stone". The crushed stone shall be washed stone or gravel free of organic materials. Gradation and durability shall conform to ASTM C-33, Size 57, 1' to NO. 4.
- 2.2.2 Materials used for the base under layer shall be crushed stone meeting the following, or near, gradation:

<u>Sieve</u>	<u>Total % Passing</u>
1"	100
3/4"	90 - 100
3/8"	50 - 95

# 4	35 - 80
# 10	25 - 65
# 40	10 - 35
# 100	3 - 10

2.3 HOT MIX ASPHALT

- 2.3.1 Hot mix asphalt for surface courses shall consist of coarse and fine aggregates and mineral filler plant-mixed with bitumen binder.
- 2.3.2 All hot mix asphalt shall be in accordance with applicable provisions of State or Provincial Department of Transportation "Standard Specifications for Road and Bridge Construction", except as herein modified.
- 2.3.3 The hot mix asphalt shall be plant-mixed and the bituminous material for mixture shall be AC-1, 85 - 100 penetration grade or 60 - 70 penetration grade where required in warm climates. The asphaltic cement (AC-1) content shall be 4.0 % - 6.0% (by weight) of the total composite mixture.
- 2.3.4 Coarse aggregate (material retained on the 4.75mm sieve) shall be sound, angular crushed stone or gravel (shale is not recommended).
- 2.3.5 Fine aggregate (material passing the 4.75mm sieve and retained on the # 200 (0.075mm) sieve) shall be sand, stone sand and stone screening Class B quality or better and gradation FA -3.
- 2.3.6 Mineral filler (Material passing the # 200 (0.075mm) sieve) shall be dry limestone or dust.
- 2.3.7 The aggregate shall have the following maximum limits of detrimental substances:

Soft fragments, AASHO Ti 89:	2.00%
Coal and lignite, AASHO Ti 13:	0.25%
Clay lumps, GHD 1:	0.25%
Flat or elongated pieces (length greater than five times average thickness):	10.00%
Sulfur content computed as sulfide sulfur, ASTM E30:	0.01%
Other local detrimental Substances:	2.00%

- 2.3.8 The gradation of the composite aggregate for the Asphalt Binder Course shall conform to or near the following:

<u>Sieve</u>	<u>Total % Passing</u>
¾"	100
½"	90 - 100
3/8"	80
# 4	45 – 70
# 8	25 - 55
# 30	(19)
# 50	5 – 20 (12)
# 100	5 – 16 (6.5)
# 200	2 – 9 (3)

Note: The aggregate grain should be as close as possible to the figures in brackets to give maximum density to the asphalt mixture.

- 2.3.9 The gradation of the composite aggregate for the Asphalt Top Coat shall conform to or near the following:

<u>Sieve</u>	<u>Total % Passing</u>
1/2"	100
3/8"	90 – 100 (100)
# 4	60 – 90 (70)
# 8	35 – 65 (49)
# 30	(22)
# 50	6 – 25 (14)
# 100	(8)
# 200	2 – 10 (3)

Note: The aggregate grain should be as close as possible to the figures in brackets to give maximum density to the asphalt mixture.

A majority of the minus 200 material should consist of mineral filler.

The increase in the amount of mineral filler has, in many instances, increased the toughness of the asphalt. This can be accomplished by using a resultant mineral aggregate having a minus 200 content of about 7% - 8%.

- 2.3.10 The asphalt "Binder Course" and "Top Coat" mixtures are the type IV mixes recommended by the Asphalt Institute. Asphaltic concrete mixtures may differ from the above provided specifications, meet or exceed the present specifications. The synthetic surfacing contractor must be informed about proposed changes/deviations to the present specifications. Determination of the job mix formula shall be based on attaining a mix having a Marshall Stability (ASTM D1559, 75 blows each Side) of 750 lbs. or greater.

- 2.3.11 Samples of the job mix from the asphalt plant shall be laboratory tested for Marshall Stability. A compacted specimen shall be retained for density (ASTM D2726) comparison with core samples from the installed pavement.

2.4 PRIME COATS AND TACK COATS

- 2.4.1 The primer for application on crushed stone base under layers (prime coat) shall be MC-1.

- 2.4.2 The primer for application on asphalt surfaces (tack coat) shall be RC-1.

SECTION 3 - EXECUTION

3.1 SUB-GRADE

- 3.1.1 The excavation levels should be determined to allow paving, pits, etc. to rest on firm, load bearing, undisturbed sub-soil, also capable of properly supporting the paving equipment and haul trucks.

- 3.1.2 The sub-soil shall be excavated and compacted to a surface parallel to the theoretical finished surface of the pavement and at a depth below it equal to the compacted thickness of the subsequent layers.
- 3.1.3 The excavation shall proceed in such a manner that disturbance of soils below the excavation level by equipment is avoided.
- 3.1.4 Surface shape of the sub-grade shall be such that water cannot accumulate at any point. If this is not possible, it is important to provide all necessary equipment, including automatically operated pumps and piping to run-off facilities, to maintain the excavations, pits, depressions free from accumulated water during the entire period of construction.
- 3.1.5 Excavation may encounter soft, non-bearing soils below the excavation level over some of the area. When the nature at the soil is such that appropriate load bearing cannot be achieved at the excavation levels originally designed, additional excavation to good bearing is necessary. The non-bearing material will be replaced with suitable ordinary fill as will permit rough grades to be as specified.
- 3.1.6 When encountered in the work and indicated on the drawings, all existing active sewer, water, gas, electric, steam, irrigation and other utility services and structures shall be protected at all times and, if required for the proper execution of the work, shall be relocated.
- 3.1.7 The sub-soil shall be rolled and compacted by a roller to a minimum density at ninety-five percent (95%) as determined by the Modified Proctor Test (AASHTO T99).
- 3.1.8 Should a section of the work be not acceptable on the basis of inadequate compaction, further compaction effort shall be applied until the specified standard is achieved.
- 3.1.9 If the moisture content varies outside the specified limits, add water or allow drying as necessary; before commencing rolling mix mechanically for a minimum depth of mm 300 to ensure uniform distribution of moisture.
- 3.1.10 Surface shape of the sub-grade shall comply with the tolerances itemized in the following table:

Item	Characteristic	Tolerance
Sub-grade	Level	+20mm/-20mm
	Thickness	Unspecified

- 3.1.11 Should a section of the work be not acceptable on the basis of level, high areas shall be graded off, low areas shall be corrected by adding and compacting material similar to that already in place.
- 3.1.12 If the sub-grade has dried and becomes loose and dusty due to construction traffic, it should be watered, lightly bladed and rolled prior to placement of the sub-base layer.
- 3.1.13 The placement of the sub-base layer shall not be commenced until the sub-grade has been approved following inspection and/or testing.

3.2 SUB-BASE AND BASE UNDER LAYER

- 3.2.1 Each layer of the pavement shall be completed to a surface parallel to the theoretical finished surface of the pavement and at a depth below it equal to the compacted thickness of the subsequent layers.
- 3.2.2 Surface shape of each layer shall be such that water cannot accumulate at any point. If this is not possible, it is important to provide all necessary equipment, including automatically operated pumps and piping to run-off facilities, to maintain the excavations, pits, depressions free from accumulated water during the entire period of construction.
- 3.2.3 All fill material and crushed stone shall be spread evenly by direct tipping from suitable vehicles or by the use of a mechanical spreader above the approved sub-grade. Care should be taken to avoid segregation of granular material during tipping and spreading.
- 3.2.4 Layers of pavement material shall be not less than 4" (10 cm) in compacted thickness. Maximum layer thickness shall be limited to that which will allow compaction to specified densities by the equipment in use.
- 3.2.5 Ordinary fills material and crushed stone, when delivered, shall have a moisture content within +/- 2% of the modified optimum moisture content. During compaction moisture content shall be maintained in the correct range. If the fill material or crushed stone does not contain the proper moisture content for compaction, it shall be wetted or dried as required before rolling. Water spraying equipment used for this purpose shall be capable of uniformly distributing water in controlled quantities over uniform lane widths.
- 3.2.6 Each layer of the ordinary fill material shall be disked whenever necessary to break down clods, thoroughly mix the different materials, secure a uniform moisture content and ensure uniform density and proper compaction.
- 3.2.7 When the moisture content and condition of each spread layer is satisfactory, the area shall be rolled by an approved type roller to a minimum density of ninety-five (95%) as determined by the Modified Proctor Test (AASHTO). The final rolling shall be accomplished with a tandem steel roller. Rollers of variable mass shall receive ballast to the greatest mass that can be supported without distress to the pavement or sub-grade.
- 3.2.8 Surfaces of fine crushed rock shall be constructed slightly higher than the specified levels and cut to profile by power grader towards the end of the compaction process. Rolling shall then continue to specified density to produce a tight, even surface without loose stones or slurry of fines.
- 3.2.9 Should a section of the work be not acceptable on the basis of inadequate compaction, further compaction shall be applied until the specified standard is achieved. If the moisture content varies outside the specified limits, add water or allow drying as necessary. Before commencing rolling mix mechanically for the full depth of the layer to ensure uniform distribution of moisture.

3.2.10 Pavement base under layer courses shall comply with the tolerances itemized in the following table:

Item	Characteristic	Tolerance
Base under layer	Level	+5mm / -5mm
	Straightness	6mm maximum deviation from 4 meter straight-edge in all directions
	Thickness	+15mm / -15mm
Sub-base	Level	+10mm / -10mm
	Thickness	+30mm / -30mm

3.2.11 Should a section of the work be not acceptable on the basis of elevation, flatness or depth, high areas shall be graded off, low areas shall be scarified to the full layer depth, built up as necessary and re-compacted as specified.

3.2.12 Each successive layer shall not be commenced until the underlying layer has been approved following inspection and/or testing.

3.2.13 The base under layer must be firm, non-yielding and not pumping under the travel of haul trucks and other construction equipment at the time of the laying of the hot mix asphalt. Base under layers that show movement under trucks or construction equipment will need additional compaction work or other remedial work to repair the substandard installation.

3.3 HOT MIX ASPHALT PAVEMENT

3.3.1 Mixing of hot mix asphalt should be undertaken in a mixing plant capable of effectively drying and heating the aggregate to the specified temperature, accurately proportioning and uniformly mixing coarse and fine aggregate, filler and binder to meet the specified requirements at all times.

In general, batch-mixing plants are preferable to drum mixing plants, because of their greater capability to fine-tune the aggregate gradation.

For all types of mixing facilities:

- Cold aggregates must be handled and stored in a manner that avoids contamination and minimizes degradation and segregation.
- Filler shall be stored and handled in a separate system from that which handles aggregate
- The bitumen storage and handling shall be arranged so that contamination of the bitumen by flushing liquids or other materials cannot occur.
- The bitumen storage tanks shall be capable of holding at least sufficient bitumen for one day's production.
- Heating of bitumen shall be accomplished by steam coils, electricity or other means that will allow no direct flame to come into contact with the heating tank.
- Discharge from the plant shall be so arranged as to minimize segregation.
- Asphalt, which has been stored for more than twenty-four hours or produced at temperatures not in accordance with those specified, shall not be used.
- The mix shall leave the mixing facility at a temperature between 285°F (140°C) and 325°F (163°C).

- 3.3.2 The hot mix asphalt must be kept clean during hauling and covered if necessary during transit with canvas or other material that will retain the desired pavement temperatures. The mixtures must not be hauled in such a manner that segregation of the ingredients takes place or that a crust is formed on the surface, or that mixture will crumble or flatten out when dumped. Trucks that transport the mixture must have metal beds, and the beds must be clean, smooth and free of holes. Before loading, the truck bed is coated with a thin film of a release agent (oil or soap solution) that assists in preventing fresh hot mix asphalt from sticking to the surface of the bed. After the bed is coated, any excess release agent must be drained from the bed.
- 3.3.3 The hot mix asphalt shall be spread with a self-propelled machine spreader having a floating screed assembly controlling the elevation of the strike-off. The use of road graders or towed spreaders will not be allowed. Means shall be provided to heat the screed uniformly over its full width. The screed shall be equipped with automatic screed controls to adjust automatically to place a uniform mat of desired thickness, grade and shape.
- 3.3.4 Typical members of the paving crew should be: paving superintendent, paver operator, dump person, two screed people, and two people to lute and take care of joints and mat repairs. Co-ordination of the entire crew with the paving superintendent and screed people is essential to achieve all the desired goals.
- 3.3.5 Self-propelled rollers are required as compaction equipment. Towed-type rollers should not be used.
Hand-held or vibrating plate compactors can be used in small, inaccessible areas. Steel-wheeled non-vibrating rollers shall have a mass of 10 tons (9 metric tons). Steel wheeled vibrating rollers shall have a mass of 5 tons (4.5 metric tons). Pneumatic tired multi-wheeled rollers shall not be used.
- 3.3.6 The hot mix asphalt shall be placed with a minimum delay after delivery. On no account shall hot mix asphalt be reheated.
- 3.3.7 The day's work shall be organized so that each layer spread covers the full width of the pavement.
- 3.3.8 Hot mix asphalt shall be spread to a depth consistent with the specified compacted thickness. Each layer shall be completed to a surface parallel to the finished surface of the pavement and at a depth below it equal to the compacted thickness of the subsequent layer or layers specified.
- 3.3.9 Hot mix asphalt shall not be placed during rain, or when the air temperature in the shade and away from artificial heat is 40°F (5°C) or less, or while the surface is wet or when the pavement temperature does not comply with the Table below.

Pavement surface temperature in shade	Minimum Laying Temperatures Binder Course	Minimum Laying Temperature Top Coat
40°F - 50°F (5°C - 10°C)	302°F (150°C)	293°F (145°C)
50°F - 60°F (10°C - 15°C)	293°F (145°C)	284°F (140°C)
60°F - 77°F (15°C - 25°C)	284°F (140°C)	275°F (135°C)
Over 77°F (Over 25°C)	275°F (135°C)	266°F (130°C)

3.3.10 Maximum laying temperature of the mixture shall be 325°F (163°C)

3.3.11 The temperature of the mix shall be measured in the truck just prior to discharging into the paver hopper. A suitable stem type thermometer shall be used. The stem shall be inserted into the mix to a depth of approximately 8" (200mm) at a location at least 12" (300mm) from the side of the truck body. An average of at least two readings shall be adopted as the temperature of the mix.

3.3.12 There are three acceptable types of sensing devices used with the automatic screed control system:

- The Wand Sensor
- The Ultra Sonic Sensor
- The Laser Sensor

3.3.13 The grade reference used with the above listed sensing devices can be either a fixed string-line tied between graded iron pins or on an existing surface, a previously placed surface, a curb line, etc.

A string-line can be erected that will include roll down factors for true grade. The roll down is estimated to be about 25% of the un-compacted mat thickness. To calculate the exact position of the string-line, a survey crew is used to determine the existing grade at approximate intervals of 9 meters (30 feet). The existing grade is subtracted from the theoretical grade for calculation of lift thickness. A roll down factor of 25% of this thickness is added for the string-line grade. Once the string-line is erected, intermediate points of support may be placed under the string-line, especially on curves or in sudden changes of grade.

Graded iron pins and intermediate supports should be placed so that they will not interfere with the travel of the machine spreader, but close enough to each other and to the path of the machine spreader that they can hold the string in a convenient position to be reached by the electronic sensors and by a short straight edge placed on the newly laid pavement to visual check on its level.

3.3.14 The reference system that is best for the job depends on the existing pavement surface on which the mat is to be placed.

If the surface on which the mat is to be placed has an appropriate longitudinal grade, so that the finished pavement is expected to have a constant thickness, then the surface on which the mat has to be placed, an adjoining existing surface, a previously placed surface, a curb line, etc. can be used as the reference system, since a constant roll down is expected.

If the longitudinal grade is erratic, so that the finished pavement is expected to have a variable thickness, a string-line should be used as the reference system, to take in account the variable roll down.

3.3.15 To maintain proper transverse grade, automatic screed controls use:

- A dual sensing systems on both sides of the paver, using two grade references, one on each side of the paver or
- A single sensing system on a single side of the paver, using a single grade reference on a single side of the paver, in association with an automatic slope control system: in using the transverse slope control, no specific roll down factors can be applied to grade calculations for slope transfer.

The Control System that is best for the job depends on the existing pavement surface on which the mat is to be placed.

Dual Grade Control System is preferable if the surface on which the mat has to be placed has an unsatisfactory transverse grade.

Single Grade Control System transfers the roll-down factors of the grade control side to the opposite side as equal factors, which may or may not be equal. Single Grade Control System is acceptable in situations where the surface on which the mat is to be placed has an appropriate transverse grade.

- 3.3.16 The area to be surfaced with hot mix asphalt shall be cleared of all foreign or loose material with power blowers, power brooms or hand brooms.

- 3.3.17 Crushed stone or asphalt surfaces shall be primed prior to the installation of the binder course and topcoat.

Prime crushed stone surfaces at the rate of 0.3 gallons per square yard.

Prime asphalt surfaces at the rate of 0.05 gallons per square yard.

Sprayers shall be capable of spraying the tack coat uniformly through jets in a spray bar at the desired rate of application.

Each sprayer shall be fitted with a hand lance.

Tack Coat shall be applied, not less than thirty (30) minutes nor more than two (2) hours before asphaltic concrete is placed.

When spraying the tack coat, shields shall be used and all necessary precautions taken to protect curbs, gutters, channels, adjoining structures, surfaces and grassed areas.

Any pools of tack coat, which may form in small depressions or surface irregularities, shall be brushed out over the adjacent area with brooms or rubber squeegees before the emulsion breaks.

In dusty conditions, every precaution shall be taken to prevent freshly coated surfaces from being contaminated by dust or other foreign material.

- 3.3.18 Uniformity of operations is essential in hot mix asphalt paving. Uniform, continuous operation of the paver produces the highest quality pavement.

Paving too fast can result in the paver stopping frequently to wait for trucks to bring more mix. The smoothness of the pavement will suffer when the paver stops and starts up again. The paver speed should be matched to the quantity of HMA being delivered to the project to provide a uniform paver speed.

The paver must be continuously supplied with enough mix, and at the same time, trucks should not have to wait a long time to discharge their loads into the paver hopper.

- 3.3.19 Starting blocks equal to 1.25 times the thickness of the un-compacted mat are required to set the thickness and to null the screed. By using starting blocks the grade can be very close at the beginning of the operation.

- 3.3.20 Blocks equal to 25% of the un-compacted thickness are used to start from a joint. The 25% additional thickness allows for proper roll-down or compaction while maintaining proper grade.

Extended screeds will require multiple shims for each extension area.

- 3.3.21 The screed must be initially heated at the start of each new paving operation. If not, the mix will tear and the texture will look open and coarse, as if the mix were too cold.

- 3.3.22 If the mat being placed is uniform and satisfactory in texture, and the thickness is correct, no screed adjustments are required. But when adjustments are required, they should be made in small increments. Time should be allowed between the adjustments to permit the paver screed to complete reaction to the adjustments sequentially.
- 3.3.23 The minimum un-compacted thickness of a hot mix asphalt course is equal to 1.25 times its minimum compacted thickness, which is equal to three times the nominal maximum size aggregate. When the mat falls below this thickness, it pulls, tears, cools rapidly and generally will not be able to achieve the proper density and pavement smoothness.
- 3.3.24 There are places on many projects where spreading with a paver is either impractical or impossible. In these cases, hand spreading may be required. Placing and spreading by hand should be done very carefully and the material distributed uniformly so there will be no segregation of the mix. When the HMA is dumped in piles, it should be placed upon arrival on steel dump sheets outside the area in which it is to be spread and shall then be immediately laid to the required depth. The material should be deposited from the shovels into small piles and spread with lutes. In the spreading process, all material should be thoroughly loosened and evenly distributed. Any part of the mix that has formed into lumps and does not break down easily should be discarded. After the material has been placed and before rolling starts, the surface should be checked with templates or straightedges and all irregularities corrected.
- 3.3.25 Asphaltic concrete shall be spread in such a manner as to minimize the number of transverse and longitudinal joints in the pavement.
- 3.3.26 Transverse joints shall be constructed where the spreading operation is stopped for longer than 20 minutes. Transverse joints in adjoining spreader runs shall be offset by not less than 8 feet (2.44m). Transverse joints shall be offset from layer to layer by not less than 8 feet (2.44m). Transverse joints shall be constructed at right angles to the direction of spreading and be cut to a straight vertical face for the full depth of the layer.
- 3.3.27 When the construction is ready to stop for the end of the day or for a period longer than 20 minutes, the following procedure is used to form a suitable transverse joint:
1. When the paver is placing the last load, it is shifted into low gear as it approaches the location of the proposed joint.
 2. As the hopper empties and the amount of material in the screed chamber decreases below normal operating level, the paver is stopped.
 3. The screed is raised and the paver moved out of the way.
 4. The mix is then removed from the end of the mat to form a clean, vertical edge.
 5. Heavy wrapping paper is placed on the existing surface along the edge of the joint.
 6. New material is finally placed on top of the paper and used to form a ramp, from the new surface to the existing surface.

3.3.28 When construction is ready to resume, the following procedure is used to form a suitable transverse joint:

1. The ramp of material is removed along with the board or paper.
2. A straightedge is used to check the longitudinal grade of the mat. Because the paver was running out of material as it laid the last few feet of mat, it is possible that those last few feet taper slightly from the specified level of the mat. If this is the case, a new transverse edge must be cut behind the point where the taper begins.
3. The vertical face of the mat is tack-coated.
4. The paver is backed up to the edge of the mat and the screed rested on the mat surface.
5. The screed is heated while it rests on the mat. This provides some heat to the material at the edge of the mat.
6. The heated screed is raised and shims as thick as the difference between the compacted and the un-compacted mat (approximately 25% of the compacted thickness) are positioned under its ends.
7. The truck with the first load of HMA is backed carefully to the hopper. During discharge of the mix from the truck bed to the paver, it is essential that the truck not bump the paver and cause it to move.
8. The paver starts forward in a low gear.
9. Once the paver has moved away, excess asphalt is cleaned off the surface of the mat and the smoothness of the joint is checked with a straightedge.
10. If the joint is satisfactory, a 6" (150mm) width of the fresh mix is rolled transversely and the joint checked for smoothness. If the joint is satisfactory, transverse rolling is continued in 6" to 12" (150 to 300mm.) increments until the entire width of the roller is on the new HMA. If straight edging shows an uneven joint, the surface of the new mat must be scarified while still warm and workable. Scarification is done with the fine side of the lute. Excess material can then be removed or additional material added, and the joint rolled. During rolling, timbers should be placed along the edges of the mat to prevent the roller from driving off the longitudinal edge and distorting it.

3.3.29 Longitudinal joints shall be offset from layer to layer by not less than 6" (150mm). Longitudinal joints shall be parallel to the centerline of the pavement. Alignment of the mat is dependent on the accuracy of the guideline provided for the paver operator and his alertness in following it. Attention to this detail is vital to the construction of a satisfactory longitudinal joint, since only a straight edge can be properly matched to make the joint

3.3.30 Hot joints are formed by two pavers operating in echelon. The screed of the rear paver is set to match the grade or thickness of the unrolled edge of the first mat placed. The advantages of a hot joint are that the two mats are automatically matched in thickness; the density on both sides of the joint is uniform because both sides are compacted together, and the hot mats form a solid bond. The disadvantage is that traffic cannot move in one of the lanes while the other is being paved. Both lanes are blocked simultaneously.

3.3.31 In building a cold joint, one lane is placed and compacted. At a later time, after the HMA in the first lane has cooled, the companion lane is placed against it and compacted. Special precautions must be followed to ensure a joint of good quality.

3.3.32 The following procedure is used to form a suitable longitudinal joint:

1. The exposed edge of the first lane shall be formed while hot to a straight line with a dense face, which shall lie between vertical and 45° to the vertical for the full depth of the layer.
2. The unsupported longitudinal edges of spread material should be side tamped to raise the level of the asphaltic concrete slightly to secure maximum edge compaction from subsequent rolling.
3. While placing the companion lane, the paver screed should be set to overlap the first mat by 1" to 2" (25 to 50 mm).
4. The elevation of the screed above the surface of the first mat should be equal to the amount of roll-down expected during compaction of the new mat.
5. The coarse aggregate in the material overlapping the cold joint should be carefully removed and wasted. This leaves only the finer portion of the mixture to be pressed into the compacted lane at the time the joint is rolled.

3.3.33 The placing of hot mix asphalt against abutting structures such as curbs, gutter manhole or adjoining pavement shall be carried out in the same manner as for longitudinal and transverse joints. Any spaces left unfilled between the spreader run and abutting edges shall be filled with sufficient material to the proper height prior to compaction.

3.3.34 After the paving mixture has been properly spread; it shall be thoroughly and uniformly compressed by rolling with power rollers.

3.3.35 Hot mix asphalt shall be compacted uniformly to the standard specified as soon as it will support rollers without undue displacement. All rolling shall be completed while the mix is at a temperature above 185°F (85°C)

3.3.36 The pavement shall be compacted to 97% or more of the density (ASTM F2726) obtained on a retained job mix specimen by the seventy-five blow Marshall procedure (ASTM D1559), Marshall stability (ASTM D1559) shall be 750 lbs. or greater.

3.3.37 The exact number of passes of a roller that will be required to obtain adequate density will be determined on a test strip using a nuclear density gauge to measure the density of the mat after each pass, until maximum achievable density is indicated by the test results. The rolling pattern used on the test strip should be the same that will be used on the remainder of the job. The number of rollers and/or the rate of production will be adjusted accordingly.

3.3.38 The speed of rollers at all times shall be slow enough to avoid displacement of the mix and shall not be greater than 3 mph (5 km/h).

3.3.39 Steel wheel rollers shall be operated with minimum wetting of rollers.

3.3.40 The driving roll shall be nearer the spreader.

3.3.41 Vibratory mechanisms shall be disengaged before stopping or reversing direction.

3.3.42 Rollers shall not remain stationary on asphaltic concrete while it is still warm. Roller wheels shall be kept free from any buildup.

- 3.3.43 The roller shall pass over the unprotected end of the freshly laid mixture only when a transverse joint has to be made.
- 3.3.44 Initial (breakdown) rolling shall be performed with a static steel-wheeled roller. Transverse joints shall be rolled first, then the longitudinal joint and the outside edge. Breakdown rolling shall continue longitudinally, commencing on the lower side and proceeding to the higher side of the spreader run. The roller shall overhang the unsupported edges of the run by about 4-inch (100mm). Each longitudinal pass shall overlap the previous pass by about 4-inch (100mm) and adjacent passes of the roller shall be of different lengths.
- 3.3.45 Secondary rolling to obtain required density before the mixture cools to 1850F (850C) shall be performed as soon as possible after initial rolling and shall be performed with a static or a vibratory steel wheeled roller. Rolling shall be carried out longitudinally commencing on the lower side and proceeding to the higher side of the spreader run. Each roller pass shall overlap the previous pass and adjacent passes shall be of different lengths.
- 3.3.46 Final rolling for the improvement of the surface while the mixture is still warm enough to permit removal of any roller marks shall be performed with static steel wheeled roller.
- 3.3.47 When paving in echelon, the edge of the run common to adjacent spreaders shall be left unrolled for a width of 8 inch (200mm) until the longitudinal joint has been constructed. This strip shall be rolled together with the edge of the adjacent spreader run. Rolling shall commence before the temperature of the material along the edge of the first spreader run has fallen below 95 0C (203 0F)
- 3.4 ACCEPTANCE OF PAVING WORK - REMEDY WORK
- 3.4.1 Each successive layer shall not be commenced until the underlying layer has been approved following inspection and/or testing.
- 3.4.2 Acceptance of paving work as far as compaction and Marshall Stability specifications is concerned will be based on tests to be performed on core samples taken from each layer shortly after application. Test results shall be submitted to synthetic surfacing contractor.
- 3.4.3 Should a section of the work be not acceptable on the basis of inadequate compaction and/or the mixture became loose and broken, mixed with dirt or in any way defective, it shall be removed and replaced with fresh mixture which shall be immediately compacted to conform with the surrounding area.
- 3.4.4 Areas of one (1) square inch or more showing excess of bitumen shall be removed and replaced.
- 3.4.5 On completion of placement and compaction, pavement courses shall comply with the tolerances itemized in the following table.

Item	Characteristic	Tolerance
Top Coat	Level	+2mm / -2mm from design levels
	Thickness	+6mm / -0mm from design levels
	Flatness	3mm maximum departure from a 3m straight-edge in all directions
Binder Course	Level	+4mm / -4mm from design levels
	Thickness	+6mm / -0mm from design levels
	Flatness	4mm maximum departure from a 3m straight-edge in all directions

- 3.4.6 Surface shape of each layer of pavement shall be such that water cannot accumulate at any point and the surface shall free drain to drainage channels.
- 3.4.7 The whole surface of each layer of pavement should be checked for levels by a local surveyor, and for flatness with a 10 foot straightedge in all directions; the surface shall also be flooded and inspected for ponding, "bird baths", ridges, etc. After testing, all high and low areas shall be marked on the leveling course surface.
- 3.4.8 Low areas shall be remedied by cutting out the course to full depth (or to a minimum depth of 3/4" – 1" (20 - 25 mm)) and replacing with the correct hot mixture. The repaired area shall be thoroughly compacted to the specified tolerance. First the area must be fully tack coated. No filling by using sand mix shall be allowed. Sand asphalt lacks sufficient internal strength. No tar emulsions such as 'jet shield" or similar products shall be applied to the surface. Nor shall any other type at asphalt or tar leveling or sealing product (hot or cold) be coated on the surface,
Under specific conditions and with synthetic surfacing contractors prior approval, a polyurethane underlayment material as recommended by the manufacturer can be used for correcting small low areas. Extensive use of Polyurethane underlayment is no substitute for proper installation and leveling of the asphalt. The depth of the underlayment layer must be limited to 1/4" (6 mm) or less.
- 3.4.9 High areas shall be remedied by cutting out the course to full depth (or to a minimum depth of 3/4" – 1" (20 - 25 mm)) and replacing with the correct hot mixture. The repaired area shall be thoroughly compacted to the specified tolerance. In some cases it is practical to repair high areas and ridges by heating with a "hot iron" or a butane torch and scraping them off. These areas must be rolled smooth afterwards.
- 3.5 CURING OF HOT MIX ASPHALT INSTALLATIONS
- 3.5.1 The asphalt-leveling course will have to cure a minimum of twenty eight (28) days prior to installation of the synthetic surface in order to allow the escape of surface volatiles, oils. Etc.
- 3.6 DISCLAIMER
- 3.6.1 The above recommendations are provided for general guidance only.
The responsibility for warranties and/or performance guarantees for the proper preparation of the asphalt and stone base rests with the responsible professional, asphalt manufacturer and/or the asphalt sub-contractor in the event of base failure and not with the synthetic surfacing contractor.

The General Contractor, Architect, and/or Asphalt Sub-Contractor will be notified by the synthetic surfacing contractor of any evident defects or installation conditions, which could result in unsatisfactory performance. The responsibility for remedying defective work rests with the General Contractor and/or the Asphalt Sub-Contractor.

The synthetic surfacing contractor must be provided with the respective tests results in advance of visiting the project site if relevant commentary is expected.

The Owner can obtain written confirmation from the synthetic surfacing contractor, based on site observations and test results supplied by the contractor, that the bituminous concrete pavement appears satisfactorily finished and adequately cured to permit the installation to begin. *(Written confirmation from synthetic surfacing contractor of satisfactory completed and adequately cured asphalt pavement can be obtained by the Owner, based on synthetic surfacing contractors site observations, and test results supplied by the contractor)*

The synthetic surfacing contractor will not be held responsible for any delays past expected substantial completion dates, caused by the incorrect installation of the asphalt and/or stone base. As such no liquidating damages and or penalties will be imposed on upon the synthetic surfacing contractor. Any subsequent visits to re-inspect the corrected asphalt and or stone base will be at the Sub-Contractors/General Contractors or Owners cost.

END OF SECTION

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.
- B. Related Sections include the following:
 - 1. Division 2 Section "Earthwork" for fill under slabs-on-grade.

1.3 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mix water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- D. Formwork Shop Drawings: Design and engineering of formwork is Contractor's responsibility.
 - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
- E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Cementitious materials and aggregates.
 - 2. Form materials and form-release agents.
 - 3. Steel reinforcement and reinforcement accessories.
 - 4. Admixtures.
 - 5. Curing materials.

6. Floor and slab treatments.
7. Bonding agents.
8. Adhesives.
9. Vapor retarders.
10. Joint-filler strips.
11. Repair materials.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete Work 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. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
 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.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- E. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
 1. ACI 301, "Specification for Structural Concrete."
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum, as required for exposed columns and beams.
- D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- E. Form Ties: 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 prevent spalling of concrete on removal.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Steel Bar Mats: ASTM A 184/A 184M, assembled with clips.
 - 1. Steel Reinforcement: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars.
- C. Plain-Steel Wire: ASTM A 82, as drawn.
- D. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

- B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
- B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
 - 1. Class: Negligible weathering region, but not less than 1N.
- C. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.6 VAPOR RETARDERS

- A. Vapor Retarder: ASTM E 1745, Class C, of one of the following materials; or polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick:
 - 1. Nonwoven, polyester-reinforced, polyethylene coated sheet; 10 mils (0.25 mm) thick.
 - 2. Three-ply, nylon- or polyester-cord-reinforced, laminated, high-density polyethylene sheet; 7.8 mils (0.18 mm) thick.

2.7 FLOOR AND SLAB TREATMENTS

- A. Penetrating Liquid Floor Treatment: Chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Penetrating Liquid Floor Treatment:

- a. Titan Hard; Burke Group, LLC (The).
- b. Chemisil Plus; ChemMasters.
- c. Intraseal; Conspec Marketing & Manufacturing Co., Inc.
- d. Ashford Formula; Curecrete Chemical Co., Inc.
- e. Day-Chem Sure Hard; Dayton Superior Corporation.
- f. Euco Diamond Hard; Euclid Chemical Co.
- g. Seal Hard; L&M Construction Chemicals, Inc.
- h. Vexcon Starseal PS; Vexcon Chemicals, Inc.

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- F. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Evaporation Retarder:

- a. Finishing Aid Concentrate; Burke Group, LLC (The).
- b. Eucobar; Euclid Chemical Co.
- c. Confilm; Master Builders, Inc.
- d. SikaFilm; Sika Corporation.

2. Clear, Waterborne, Membrane-Forming Curing Compound:

- a. Klear Kote WB II Regular; Burke Chemicals.
- b. Aqua Cure VOX; Euclid Chemical Co.
- c. Vocomp-20; W. R. Meadows, Inc.
- d. Kure-N-Seal WB; Sonneborn, Div. of ChemRex, Inc.

2.9 RELATED MATERIALS

- A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

- C. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
 - 1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
 - 2. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
 - 3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.10 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
 - 1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
- C. Footings and Foundation Walls: Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): 3000 psi (20.7 MPa).
 - 2. Maximum Slump: 5 inches (125 mm).
 - 3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches (200 mm) after admixture is added to concrete with 2- to 4-inch (50- to 100-mm) slump.
- D. Slab-on-Grade and Toppings: Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): 3000 psi (20.7 MPa).
 - 2. Maximum Slump: 4 inches (100 mm).
- E. Building Frame Members: Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): 3000 psi (20.7 MPa).
 - 2. Maximum Slump: 5 inches (125 mm).
 - 3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches (200 mm) after admixture is added to concrete with 2- to 4-inch (50- to 100-mm) slump.
- F. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2 to 4 percent, unless otherwise indicated.
- G. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.
- H. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

- I. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) 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.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.11 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class B, 1/4 inch (6 mm), for surfaces to receive stucco.
 - 2. Class C, 1/2 inch (13 mm), for permanently exposed surfaces without finish.
 - 3. Class D, 1 inch (25 mm), for permanently concealed surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush 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, for easy removal.

1. Do not use rust-stained steel form-facing material.
- F. 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.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete, as required.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 1. Install anchor bolts, accurately located, to elevations required.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
- B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
 1. 28-day design compressive strength.
 2. At least 70 percent of 28-day design compressive strength.
 3. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.

4. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
 - C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
 - D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.
- 3.4 SHORES AND RESHORES
- A. Comply with ACI 318 (ACI 318M), ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.
 - B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.
- 3.5 VAPOR RETARDERS
- A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.
- 3.6 STEEL REINFORCEMENT
- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
 - B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
 - C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
 - E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 - 3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch (12 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Architect.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

- D. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- E. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to 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.

3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm) in height.
 - 1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
 - 2. Do not apply rubbed finish to smooth-formed finish.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces 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.

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
- D. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
- E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by 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 bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.12 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m 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.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:
 - 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 (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a

second coat. Maintain continuity of coating and repair damage during curing period.

3.13 LIQUID FLOOR TREATMENTS

- A. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.2-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.
- 3.15 FIELD QUALITY CONTROL
- A. Testing Agency: Engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.
- 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 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mix placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, 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 mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 - a. Cast and field cure one set of four standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39; test one laboratory-cured specimens at 7 days and two at 28 days, and one specimen retained in reserve for later testing if required.
- C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- D. Strength of each concrete mix will be satisfactory if every 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 (3.4 MPa).
- E. 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 mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
- F. 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.
- G. 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. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

END OF SECTION 03300

SECTION 04810 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
 - 1. Concrete masonry units.
 - 2. Mortar and grout.
 - 3. Reinforcing steel.
 - 4. Masonry joint reinforcement.
 - 5. Miscellaneous masonry accessories.
- B. Related Sections include the following:
 - 1. Division 7 Section "Sheet metal Flashing and Trim" for exposed sheet metal flashing.
- C. Products installed, but not furnished, under this Section include the following:
 - 1. Manufactured reglets in masonry joints for metal flashing, furnished under Division 7 Section "Sheet Metal Flashing and Trim."
 - 2. Hollow-metal frames in unit masonry openings, furnished under Division 8 Section "Steel Doors and Frames."

1.3 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following net-area compressive strengths (f'_m) at 28 days. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
 - 1. For Concrete Unit Masonry: $f'_m = 1500$ psi (10.3 MPa).

1.5 SUBMITTALS

- A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
- C. Samples for Verification: For the following:
 - 1. Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
 - 2. Color mortar samples for each color required showing the full range of colors expected in the finished construction.
 - 3. Weep holes/vents in color to match mortar color.
- D. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
 - 1. Each type of masonry unit required.
 - a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
 - b. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.
 - 2. Mortar complying with property requirements of ASTM C 270.
 - 3. Grout mixes complying with compressive strength requirements of ASTM C 476. Include description of type and proportions of grout ingredients.
- E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Each type of masonry unit required.
 - a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
 - b. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.
 - 2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
 - 3. Each combination of masonry unit type and mortar type. Include statement of net-area compressive strength of masonry units, mortar type, and net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
 - 4. Each material and grade indicated for reinforcing bars.
 - 5. Each type and size of joint reinforcement.
 - 6. Each type and size of anchor, tie, and metal accessory.

- F. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E329 and ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.
- E. Mockups: Before installing unit masonry, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed work:
 - 1. Build mockups for the following types of masonry in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories. Include a sealant-filled joint at least sixteen (16) inches long in each mockup.
 - a. Typical exterior wall with through-wall flashing installed for a 24-inch length in corner of mockup approximately sixteen (16) inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 - 2. Clean exposed faces of mockup with masonry cleaner as indicated.
 - 3. Notify Architect seven days in advance of dates and times when mockup is constructed.
 - 4. Protect accepted mockup from the elements with weather-resistant membrane.
 - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
 - 6. Demolish and remove mockups when directed.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units 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.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
- 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. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. 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.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. 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 (38 deg C), or 90 deg F (32 deg C) with a wind velocity greater than 8 mph (13 km/h), do not spread

mortar beds more than 48 inches (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. General: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners, unless indicated as bullnose.

B. Concrete Masonry Units: ASTM C 90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).
2. Weight Classification: Normal weight.
3. Provide Type II, nonmoisture-controlled units.
4. Size (Width): Manufactured to the following dimensions:
 - a. 8 inches (203 mm) nominal; 7-5/8 inches (194 mm) actual.
 - b. 12 inches (305 mm) nominal; 11-5/8 inches (295 mm) actual.
5. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.
 - a. Where units are to receive a direct application of stucco (cement plaster), provide textured-face units made with gap-graded aggregates.

C. Decorative Concrete Masonry Units: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).
2. Weight Classification: Normal weight.
3. Size (Width): Manufactured to dimensions specified in "Concrete Masonry Units" Paragraph above.
4. Pattern and Texture:
 - a. Standard pattern, split-face finish.
 - b. Scored vertically so units laid in running bond appear as square units laid in stacked bond, standard finish.
5. Colors: As selected by Architect from manufacturer's full range.

2.2 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

- B. Hydrated Lime: ASTM C 207, Type S.
- C. Mortar Cement: ASTM C 1329.
- D. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
- E. Aggregate for Grout: ASTM C 404.
- F. Water: Potable.
- G. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Mortar Cement:
 - a. Magnolia Superbond Mortar Cement; Blue Circle Cement.
 - b. Lafarge Mortar Cement; Lafarge Corporation.

2.3 REINFORCING STEEL

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M.; Grade 60 (Grade 400).

2.4 MASONRY JOINT REINFORCEMENT

- A. General: ASTM A 951 and as follows:
 - 1. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.
 - 2. Wire Size for Side Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
 - 3. Wire Size for Cross Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
 - 4. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units where indicated.
- B. For single-wythe masonry, provide truss type with single pair of side rods and cross rods spaced not more than 16 inches (407 mm) o.c.

2.5 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
 - 1. Styrene-Butadiene-Rubber Compound: ASTM D 2000, Designation M2AA-805.

- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.6 MASONRY CLEANERS

- A. Job-Mixed Detergent Solution: Solution of ½-cup (0.14-L) dry measure tetrasodium polyphosphate and ½-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal. (4 L) of water.

2.7 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

- 1. Do not use calcium chloride in mortar or grout.

- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.

- 1. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
 - 2. For masonry below grade, in contact with earth, and where indicated, use Type S.
 - 3. For reinforced masonry and where indicated, use Type S.
 - 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

- C. Grout for Unit Masonry: Comply with ASTM C 476.

- 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143.

2.8 PRECAST CONCRETE LINTELS

- A. Precast Concrete Lintels: Provide manufacturer's standard precast concrete lintels Of the size, shape and length indicated.

2.9 SOURCE QUALITY CONTROL

- A. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.
- D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.

3.3 CONSTRUCTION TOLERANCES

- A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:
- B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.

- C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), nor ½ inch (12 mm) maximum.
- D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet (6 mm in 6 m), nor ½ inch (12 mm) maximum.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch (100-mm) 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.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.
- F. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.
- G. 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.
- H. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow masonry units as follows:
 - 1. With full mortar coverage on horizontal and vertical face shells.

2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

3.6 MASONRY JOINT REINFORCEMENT

- A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
 1. Space reinforcement not more than 16 inches (406 mm) o.c.
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
- B. Form control joints in concrete masonry as follows:
 1. Install preformed control-joint gaskets designed to fit standard sash block.
 2. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete.

3.8 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
 1. Provide precast lintels made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcing bars indicated or required to support loads indicated. Cure precast lintels by the same method used for concrete masonry units.
- B. Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

3.9 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
 - 1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
 - 1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.10 FIELD QUALITY CONTROL

- A. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.
- B. Mortar properties will be tested per ASTM C 780.
- C. Grout will be sampled and tested for compressive strength per ASTM C 1019.

3.11 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 04810

SECTION 06100 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Wood blocking and nailers.
 - 2. Wood furring.
 - 3. Sheathing.
 - 4. Plywood backing panels.
- B. Related Sections include the following:
 - 1. Division 6 Section "Metal-Plate-Connected Wood Trusses."

1.3 DEFINITIONS

- A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.
- B. Exposed Framing: Dimension lumber not concealed by other construction.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NLGA - National Lumber Grades Authority.
 - 2. SPIB - Southern Pine Inspection Bureau.

1.4 SUBMITTALS

- A. Product Data: For each type of 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. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

1.6 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. 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.
 3. Provide dressed lumber, S4S, unless otherwise indicated.
 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.
- 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. Factory mark panels according to indicated standard.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPAC2 (lumber) and AWPAC9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPAC31 with inorganic boron (SBX).
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and one of the following:
 - a. Ammoniacal, or amine, copper quat (ACQ).
 - b. Copper bis (dimethyldithiocarbamate) (CDDC).
 - c. Ammoniacal copper citrate (CC).
 - d. Copper azole, Type A (CBA-A).
 - e. Oxine copper (copper-8-quinolinolate) in a light petroleum solvent.
 - 2. For exposed items indicated to receive a 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.
- D. Application: Treat all rough carpentry, unless otherwise indicated.
 - 1. Wood 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 (460 mm) above grade.
 - 4. Wood floor plates that are installed over concrete slabs directly in contact with earth.

2.3 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including the following:
 - 1. Rooftop equipment bases and support curbs.
 - 2. Blocking.
 - 3. Nailers.
 - 4. Furring.

- B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 19 percent maximum moisture content and any of the following species:
 - 1. Mixed southern pine; SPIB.
 - 2. Spruce-pine-fir (south) or Spruce-pine-fir; NELMA, NLGA, WCLIB, or WWPA.
 - 3. Eastern softwoods; NELMA.
- C. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 SHEATHING

- A. Plywood Roof Sheathing: Exposure 1 sheathing.
 - 1. Thickness: Not less than 5/8 inch (15.9 mm)

2.5 PLYWOOD BACKING PANELS

- A. 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 (12.7 mm) 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 rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- 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. (ASME B18.2.3.8M).
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) 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. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.7 MISCELLANEOUS MATERIALS

- A. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- C. Apply field treatment complying with AWP A M4 to cut surfaces of preservative-treated lumber and plywood.
- D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 1. CABO NER-272 for power-driven fasteners.
 2. Published requirements of metal framing anchor manufacturer.
 3. Table 2306.1, "Fastening Schedule," in the Florida Building Code.
- E. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
- F. Use finishing nails for exposed work, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or 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. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FRAMING INSTALLATION, GENERAL

- A. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.
- B. Do not splice structural members between supports.
- C. Where built-up beams or girders of 2-inch nominal- (38-mm actual-) dimension lumber on edge are required, fasten together with 2 rows of 20d (100-mm) nails spaced not less than 32 inches (812 mm) o.c. Locate one row near top edge and other near bottom edge.
 - 1. For continuous members, locate end joints over supports.

3.4 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: 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.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Sheathing:
 - a. Nail to wood framing.
 - b. Space panels 1/8 inch (3 mm) apart at edges and ends.
 - 2. Plywood Backing Panels: Nail or screw to supports.

END OF SECTION 06100

SECTION 06176 - METAL-PLATE-CONNECTED WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes wood roof and girder trusses and truss accessories.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for roof sheathing and dimension lumber for supplementary framing and permanent bracing.

1.3 DEFINITIONS

- A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NLGA - National Lumber Grades Authority.
 - 2. SPIB - Southern Pine Inspection Bureau.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As required by Building Code.
 - 2. Maximum Deflection Under Design Loads:
 - a. Roof Trusses: Vertical deflection of 1/360 of span.

1.5 SUBMITTALS

- A. Shop Drawings: Show location, pitch, span, camber, configuration, and spacing for each type of truss required; species, sizes, and stress grades of lumber; splice details; type, size, material, finish, design values, orientation, and location of metal connector plates; and bearing details.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with TPI quality-control procedures for manufacture of connector plates published in TPI 1.
 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that involves inspection by SPIB, Timber Products Inspection, TPI, or other independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
- C. Source Limitations for Connector Plates: Obtain metal connector plates through one source from a single manufacturer.
- D. Comply with applicable requirements and recommendations of the following publications:
 1. TP1 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
 2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
 3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
- E. Wood Structural Design Standard: Comply with applicable requirements in AFPA's "National Design Specifications for Wood Construction" and its "Supplement."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with TPI recommendations to avoid damage and lateral bending. Provide for air circulation around stacks and under coverings.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

1.8 COORDINATION

- A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Metal Connector Plates:
 - a. Alpine Engineered Products, Inc.
 - b. Eagle Metal Products.
 - c. Mitek Industries, Inc.
 - d. Robbins Engineering, Inc.
 - e. TEE-LOK Corporation.
 - f. Truswal Systems Corporation.
 - 2. Metal Framing Anchors:
 - a. Simpson Strong-Tie Company, Inc.

2.2 DIMENSION LUMBER

- 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. Provide dressed lumber, S4S, manufactured to actual sizes required by DOC PS 20 for moisture content specified.
 - 3. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Grade and Species: Provide dimension lumber of any species for truss chord and web members, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AFPA's "National Design Specifications for Wood Construction" and its "Supplement."

2.3 METAL CONNECTOR PLATES

- A. General: Fabricate connector plates to comply with TPI 1 from metal complying with requirements indicated below:
- B. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, 80Z (24G) coating designation; ASTM A 570/A 570M, Structural Steel (SS), Grade 33, and not less than 0.047 inch (1.2 mm) thick.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Where trusses are exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- 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. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M).
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
- G. 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. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.5 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. Before installing, splice trusses delivered to Project site in more than one piece.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal framing anchors. Install fasteners through each fastener hole in metal framing anchor according to manufacturer's fastening schedules and written instructions.
- H. Securely connect each truss ply required for forming built-up girder trusses.
 - 1. Anchor trusses to girder trusses as indicated.
- I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- J. Install wood trusses within installation tolerances in TPI 1.
- K. Do not cut or remove truss members.
- L. Replace wood trusses that are damaged or do not meet requirements.
 - 1. Do not alter trusses in field.

3.2 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.

1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

END OF SECTION 06176

SECTION 07210 - BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

1.3 THIS SECTION INCLUDES THE FOLLOWING

- 1. Concealed building insulation.
- B. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-Place Concrete."
 - 2. Division 15 Sections "Duct Insulation," "Equipment Insulation," and "Pipe Insulation."

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source.
- B. Fire-Test-Response Characteristics: Provide insulation and related 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. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - 2. Combustion Characteristics: ASTM E 136.

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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Glass-Fiber Insulation:
 - a. CertainTeed Corporation.
 - b. Johns Manville Corporation.
 - c. Knauf Fiber Glass.
 - d. Owens Corning.

2.2 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.
- B. Unfaced Mineral-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing or interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.
- C. 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.
- D. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:
 - 1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
 - 2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
- C. For wood-framed construction, install mineral-fiber blankets according to ASTM C 1320.

3.5 PROTECTION

- A. Protect installed insulation 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 07210

SECTION 07311 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Asphalt shingles.
 - 2. Underlayment.
 - 3. Ridge vents.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for roof deck wood structural panels.
 - 2. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings and counterflashings not part of this Section.

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of asphalt shingle, ridge and hip cap shingles and exposed valley lining indicated.
 - 1. Include similar Samples of trim and accessories involving color selection.
- C. Qualification Data: For Installer, including certificate signed by asphalt shingle manufacturer stating that Installer is approved, authorized, or licensed to install roofing system indicated.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for asphalt shingles.
- E. Research/Evaluation Reports: For asphalt shingles.

- F. Maintenance Data: For asphalt shingles to include in maintenance manuals.
- G. Warranties: Special warranties specified in this Section.
- H. Product Approval: Approved product listed on Florida Building Code Product Approval List.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual that is approved, authorized, or licensed by asphalt shingle roofing system manufacturer to install roofing system indicated.
- B. Source Limitations: Obtain ridge and hip cap shingles, ridge vents, and felt underlayment through one source from a single asphalt shingle manufacturer.
- C. Fire-Test-Response Characteristics: Provide asphalt shingle and related roofing materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method 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. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.
- D. Asphalt shingles must be an approved product on the Florida Building Code Product Approval List.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double-stack rolls.
 - 1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
- B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt shingle roofing to be performed according to manufacturer's written instructions and warranty requirements.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials or workmanship within

specified warranty period. Materials failures include manufacturing defects and failure of asphalt shingles to self-seal after a reasonable time.

1. Material Warranty Period: 30 years from date of Substantial Completion, prorated, with first 20 years nonprorated.
2. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds up to 110 mph for five years from date of Substantial Completion.
3. Algae-Discoloration Warranty Period: Asphalt shingles will not discolor five years from date of Substantial Completion.
4. Workmanship Warranty Period: 10 years from date of Substantial Completion.

B. Special Project Warranty: Roofing Installer's Warranty, or warranty form at end of this Section, signed by roofing Installer, covering the Work of this Section, in which roofing Installer agrees to repair or replace components of asphalt shingle roofing that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

1.9 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. Asphalt Shingles: 100 sq. ft (9.3 sq. m) of each type, in unbroken bundles.

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. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

A. Laminated-Strip Asphalt Shingles: ASTM D 3462, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.

1. Basis of Design Product:
 - a. GAF Materials Corporation; Timberline HD / Timberline Prestique 30 Architectural Shingle

2. Butt Edge: Straight cut.
3. Strip Size: Manufacturer's standard.
4. Algae Resistance: Granules treated to resist algae discoloration.
5. Color and Blends: As selected by Architect from manufacturer's full range.

- B. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40-mil- (1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. GAF Materials Corporation; StormGuard.

2.4 RIDGE VENTS

- A. Off Ridge Vent: Manufacturer's standard rigid section of 26ga galvanized metal. Paint to match roof shingles.
- B. Basis of Design Product: Semco Model #VEPGA4R01
1. 4'-0" long unit with 104 sq in of ventilation.

2.5 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized steel wire shingle nails, minimum 0.120-inch- (3-mm-) diameter, barbed shank, sharp-pointed, with a minimum 3/8-inch- (9.5-mm-) diameter flat head and of sufficient length to penetrate 3/4 inch (19 mm) into solid wood decking or extend at least 1/8 inch (3 mm) through OSB or plywood sheathing.
1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

2.6 METAL FLASHING AND TRIM

- A. Sheet Metal Flashing and Trim: Comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."
- B. Vent Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch (1.6 mm) thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 4 inches (100 mm) from pipe onto roof.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.
 - 3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
- B. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated on Drawings, lapped in direction to shed water. Lap sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Roll laps with roller. Cover underlayment within seven days.

3.3 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."
 - 1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- B. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.
- C. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.4 ASPHALT SHINGLE INSTALLATION

- A. Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip at least 7 inches (175 mm) wide with self-sealing strip face up at roof edge.
 - 1. Extend asphalt shingles 1/2 inch (13 mm) over fascia at eaves.
- C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Fasten asphalt shingle strips with a minimum of five roofing nails located according to manufacturer's written instructions.
 - 1. Where roof slope exceeds 20:12, seal asphalt shingles with asphalt roofing cement spots after fastening with additional roofing nails.
 - 2. Where roof slope is less than 4:12, seal asphalt shingles with asphalt roofing cement spots.
 - 3. When ambient temperature during installation is below 50 deg F (10 deg C), seal asphalt shingles with asphalt roofing cement spots.
- E. Off-Ridge Vents: Install vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.
- F. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
 - 1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

3.5 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
1. Owner: <Insert name of Owner.>
 2. Address: <Insert address.>
 3. Building Name/Type: <Insert information.>
 4. Address: <Insert address.>
 5. Area of Work: <Insert information.>
 6. Acceptance Date: <Insert date.>
 7. Warranty Period: <Insert time.>
 8. Expiration Date: <Insert date.>
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding <Insert wind speed> mph (m/sec);
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said

alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.

1. Authorized Signature: <Insert signature.>
2. Name: <Insert name.>
3. Title: <Insert title.>

END OF SECTION 07311

SECTION 07461 – FIBER CEMENT SHEATHING

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. Fiber-cement sheathing for ceiling installation
- B. Related Sections:
 - 1. Section 06100 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of sheathing, from manufacturer.
- B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of sheathing and related accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type, color, texture, and pattern of sheathing, including related accessories, from single source from single manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials in a dry, well-ventilated, weathertight place.

1.8 COORDINATION

- A. Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.

1.9 WARRANTY

- A. Special Warranty: Standard form in which manufacturer agrees to repair or replace sheathing that fail(s) in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracking, deforming, and fading.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Fading is defined as loss of color, after cleaning with product recommended by manufacturer, of more than 4 Hunter color-difference units as measured according to ASTM D 2244.
 - 3. Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FIBER-CEMENT SHEATHING (FOR CEILINGS)

- A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cemplank.
 - b. CertainTeed Corp.
 - c. GAF Materials Corporation.
 - d. James Hardie.
- B. Pattern: 48 inch (1200 mm) wide sheets with smooth texture.
- C. Ventilation: Provide unperforated soffit.
- D. Factory Priming: Manufacturer's standard acrylic primer.

2.2 ACCESSORIES

A. Fasteners:

1. For fastening to wood, use ribbed bugle-head screws of sufficient length to penetrate through gypsum sheathing and a minimum of 1 inch (25 mm) into wood substrate.
2. For fastening fiber cement, use hot-dip galvanized fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of sheathing and related accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

- A. General: Comply with sheathing manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 1. Do not install damaged components.
- B. Install fiber-cement sheathing and related accessories.
 1. Install fasteners no more than 24 inches (600 mm) o.c.
- C. Install joint sealants as specified in Section 07920 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07460

SECTION 07620 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following sheet metal flashing and trim:
 - 1. Formed roof drainage system.
 - 2. Formed steep-slope roof flashing and trim.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Division 7 Section "Asphalt Shingles" for installing sheet metal flashing and trim integral with roofing.
 - 3. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- C. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. 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 forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - 3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
 - 4. Details of expansion-joint covers, including showing direction of expansion and contraction.
- C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.
 - 1. Include similar Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Sheet Metal Flashing: 12 inches (300 mm) long. Include fasteners, cleats, clips, closures, and other attachments.
 - 2. Trim: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
 - 3. Accessories: Full-size Sample.

1.5 QUALITY ASSURANCE

- A. 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.

1.6 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.

1.7 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

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. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 SHEET METALS

- A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
 - 1. 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.
 - a. Fluoropolymer 2-Coat System: 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; complying with AAMA 2605.
 - 1) Color: As selected by Architect from manufacturer's full range.

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 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.
- B. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
 - 1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
 - 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
 - 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
- C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- D. Elastomeric Sealant: 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.
- E. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. 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.
- C. Fabricate 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.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.6 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Drip Edges: Fabricate from the following material:
 1. Aluminum: 0.0320 inch (0.8 mm) thick.
- B. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following material:
 1. Aluminum: 0.0320 inch (0.8 mm) thick.
- C. Base Flashing: Fabricate from the following material:
 1. Aluminum: 0.040 inch (1.0 mm) thick.
- D. Counterflashing: Fabricate from the following material:
 1. Aluminum: 0.0320 inch (0.8 mm) thick.
- E. Flashing Receivers: Fabricate from the following material:
 1. Aluminum: 0.0320 inch (0.8 mm) thick.

2.7 FINISHES

- 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, to verify actual locations, dimensions and other conditions affecting performance of work.
 - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
 - 1. Coat side of sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 1. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. 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 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
 - 1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
 - 2. Aluminum: Use aluminum or stainless-steel fasteners.
 - 3. Stainless Steel: Use stainless-steel fasteners.
- H. Seal joints with elastomeric sealant as required for watertight construction.
 - 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 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. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- I. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
 - 1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 24-inch (600-mm) centers.

- C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant.

- 1. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.

3.4 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim 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.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07620

SECTION 07920 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
 - 1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Construction joints in cast-in-place concrete.
 - b. Control and expansion joints in unit masonry.
 - c. Joints in exterior portland cement plaster systems.
 - d. Joints between different materials listed above.
 - e. Perimeter joints between materials listed above and frames of doors and windows.
 - f. Control and expansion joints in ceilings and other overhead surfaces.
 - g. Other joints as indicated.
 - 2. Exterior joints in the following horizontal traffic surfaces:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - b. Joints between different materials listed above.
 - c. Other joints as indicated.
 - 3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Tile control and expansion joints.
 - d. Vertical joints on exposed surfaces of walls and partitions.
 - e. Perimeter joints between interior wall surfaces and frames of interior doors and elevator entrances.
 - f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - g. Perimeter joints at fire-protection cabinets.
 - h. Other joints as indicated.
 - 4. Interior joints in the following horizontal traffic surfaces:

- a. Isolation joints in cast-in-place concrete slabs.
- b. Control and expansion joints in tile flooring.
- c. Other joints as indicated.

B. Related Sections include the following:

1. Division 4 Section "Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.
2. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
3. Division 9 Section "Ceramic Tile" for sealing tile joints.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch (13-mm) wide joints formed between two 6-inch (150-mm) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- E. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.
- F. Qualification Data: For Installer.
- G. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- H. Field Test Report Log: For each elastomeric sealant application.
- I. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

- J. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
1. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the commencement of the Work.
1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of nonelastomeric sealant and joint substrate indicated.
 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

- a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
5. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
 1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.

2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Product: The design for each product is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- D. Single-Component Neutral-Curing Silicone Sealant ES-1:
 1. Products:
 - a. Dow Corning Corporation; 790.
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 100/50.
 4. Use Related to Exposure: NT (nontraffic).

5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
 - a. Use O Joint Substrates: Aluminum coated with a high-performance coating.
 6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.
- E. Single-Component Neutral-Curing Silicone Sealant ES-2:
1. Products:
 - a. Dow Corning Corporation; 795.
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 50.
 4. Use Related to Exposure: NT (nontraffic).
 5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
 - a. Use O Joint Substrates: Aluminum coated with a high-performance coating and ceramic tile.
- F. Single-Component Mildew-Resistant Acid-Curing Silicone Sealant ES-3:
1. Products:
 - a. Dow Corning Corporation; 786 Mildew Resistant.
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 25.
 4. Use Related to Exposure: NT (nontraffic).
 5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
 - a. Use O Joint Substrates: Aluminum coated with a high-performance coating and ceramic tile.
- G. Single-Component Latex Firestop Sealant ES-4.
1. Basis of Design: 3M Fire Protection Products Division

2.4 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:
1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2. Available Products:

- a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
- b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

2.5 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), O (open-cell material), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. 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 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous 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 nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including 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, blast cleaning, 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. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. 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.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant 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.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

- C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. Install sealant backings of 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 sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 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.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
- H. Installation of Preformed Tapes: Install according to manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed elastomeric sealant joints as follows:
 - a. Perform 1 test for each 1000 feet (300 m) of joint length or 1 test per each floor per elevation.
 - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab in Appendix X1 in ASTM C 1193, as appropriate for type of joint-sealant application indicated.

- a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
 4. Inspect tested joints and report on the following:
 - a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - b. Whether sealants filled joint cavities and are free of voids.
 - c. Whether sealant dimensions and configurations comply with specified requirements.
 5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants 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 Substantial 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.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application JS-1: Exterior horizontal nontraffic, isolation, and contraction joints in cast-in-place concrete slabs.
 - 1. Joint Sealant: Single-component neutral-curing silicone sealant, ES-1.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- B. Joint-Sealant Application JS-2: Exterior vertical control and expansion joints in unit masonry.
 - 1. Joint Sealant: Single-component neutral-curing silicone sealant, ES-1.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- C. Joint-Sealant Application JS-3: Exterior vertical joints between different materials listed above.
 - 1. Joint Sealant: Single-component neutral-curing silicone sealant, ES-1.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- D. Joint-Sealant Application JS-4: Exterior perimeter joints between unit masonry, stucco, and frames of doors and windows.
 - 1. Joint Sealant: Single-component neutral-curing silicone sealant, ES-1.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- E. Joint-Sealant Application JS-5: Exterior control and expansion joints in ceilings and other overhead surfaces.
 - 1. Joint Sealant: Single-component neutral-curing silicone sealant, ES-1.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- F. Joint-Sealant Application JS-6: Vertical control and expansion joints on exposed interior surfaces of exterior walls.
 - 1. Joint Sealant: Single-component neutral-curing silicone sealant, ES-2.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- G. Joint-Sealant Application JS-7: Interior perimeter joints of exterior openings.
 - 1. Joint Sealant: Single-component neutral-curing silicone sealant, ES-2.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- H. Joint-Sealant Application JS-8: Interior ceramic tile expansion, control, contraction, and isolation joints in horizontal traffic surfaces.
 - 1. Joint Sealant: Single-component neutral-curing silicone sealant, ES-2.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- I. Joint-Sealant Application JS-9: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.

1. Joint Sealant: Single-component mildew-resistant acid-curing silicone sealant, ES-3.
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- J. Joint-Sealant Application JS-10: Perimeter joints between interior wall surfaces and frames of interior doors.
1. Joint Sealant: Single-component neutral-curing silicone sealant, ES-2.
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- K. Joint-Sealant Application JS-11: Perimeter joints between interior wall surfaces.
1. Joint Sealant: Single-component latex sealant, ES-4.
 2. Joint Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 07920

SECTION 08110 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Steel doors.
 - 2. Steel door frames.
- B. Related Sections include the following:
 - 1. Division 4 Section "Unit Masonry Assemblies" for installing anchors and grouting frames in masonry construction.
 - 2. Division 8 Section "Finish Hardware (Scheduled by Naming Products)" for door hardware and weather stripping.
 - 3. Division 9 Section "Painting" for field painting factory-primed doors and frames.

1.3 DEFINITIONS

- A. Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

1.4 SUBMITTALS

- A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.
- B. Shop Drawings: Show the following:
 - 1. Elevations of each door design.
 - 2. Details of doors including vertical and horizontal edge details.
 - 3. Frame details for each frame type including dimensioned profiles.
 - 4. Details and locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, accessories, joints, and connections.

- C. Samples for Verification: For each type of exposed finish required, prepare a sample not less than 3 by 5 inches (75 by 125 mm) and of same thickness and material indicated for final unit of Work.
- D. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

1.5 QUALITY ASSURANCE

- A. Steel Door and Frame Standard: Comply with the Steel Door Institute recommended specifications for Standard Steel Doors and Frames ANSI/SDI 100, unless more stringent requirements are indicated.
- B. Provide doors, frames and hardware that meet the hurricane and windload test requirements in accordance with the Florida Building code and are in compliance with the local authority having jurisdiction. All openings required to meet either the impact test or windload test as indicated by the architect shall be tested as systems with the finish hardware, hollow metal doors and frames and installed in accordance with the applicable tests. These requirements take precedence over other requirements. Provide only material that has been tested and listed by local authority for the types and sizes of doors required, and complies with the requirements of the door and door frame

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames. All steel doors and frames to be properly marked with door opening mark number to correspond with the schedule.
- B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inch (100-mm) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) spaces between stacked doors to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements and complete assembly testing for the Florida Building Code windload requirements, manufacturers offering products that may be incorporated into the Work include, the following:

1. Steel Doors and Frames:

- a. Ceco Door Products; a United Dominion Company.
- b. Curries Company.
- c. Steelcraft; a division of Ingersoll-Rand.

2.2 MATERIALS

- A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.
- C. Metallic-Coated Steel Sheets: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with an A40 (ZF120) zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.
- D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

2.3 DOORS

- A. General: Provide doors of sizes, thicknesses, and designs indicated.
- B. Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
 1. Level 1 and Physical Performance Level C, (Standard Duty), Model 1 (Full Flush).
 2. Basis of Design: Steelcraft Manufacturing – H Series with flush top closure.

2.4 FRAMES

- A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
 1. Basis of Design: Steelcraft Manufacturing – F Series.
- B. Frames of 0.042-inch (1.0-mm) thick steel sheet for:
 1. Level 1 steel doors.
- C. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.

- D. Supports and Anchors: Fabricated from not less than 0.042-inch (1.0-mm) thick, electrolytic zinc-coated or metallic-coated steel sheet.
 - 1. Wall Anchors in Masonry Construction: 0.177-inch (4.5-mm) diameter, steel wire complying with ASTM A 510 (ASTM A 510M) may be used in place of steel sheet.
- E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.5 FABRICATION

- A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.
- B. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch (1.3-mm) thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.
- C. Core Construction: One of the following manufacturer's standard core materials that produce a door complying with SDI standards:
 - 1. Resin-impregnated kraft/paper honeycomb.
 - 2. Polyurethane.
- D. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between pairs of doors. Not more than 3/4 inch (19 mm) at bottom.
- E. Single-Acting, Door-Edge Profile: Square edge.
- F. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- G. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
- H. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- I. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.

1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of 0.41 Btu/sq. ft. x h x deg F (2.33 W/sq. m x K) or better.
 - J. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
 1. For concealed overhead door closers, provide space, cutouts, reinforcement, and provisions for fastening in top rail of doors or head of frames, as applicable.
 - K. Stops and Moldings: Provide stops and moldings around louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
 - L. Frame Construction: Fabricate frames to shape shown.
 1. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
 2. For exterior and interior applications, fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
 3. Provide welded frames with temporary spreader bars.
 4. Provide terminated stops.
 - M. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
 - N. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.
- 2.6 FINISHES
- A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.
- B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 1. Place frames before construction of enclosing walls and ceilings.

2. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
- C. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.

3.2 ADJUSTING AND CLEANING

- A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.
- B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08110

SECTION 08311 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Ceiling access doors and frames.
 - 2. Wall access doors and frames.
- B. Related Sections include the following:
 - 1. Division 15 Section "Duct Accessories" for heating and air-conditioning duct access doors.

1.3 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) for access doors and frames.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain doors and frames through one source from a single manufacturer.
- B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 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 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Access Doors:
 - a. J. L. Industries, Inc.
 - b. Larsen's Manufacturing Company.
 - c. Milcor Limited Partnership.

2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M. Electrolytic zinc-coated steel sheet, complying with ASTM A 591/A 591M, Class C coating, may be substituted at fabricator's option.
- C. Drywall Beads: Edge trim formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.3 PAINT

- A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."

2.4 ACCESS DOORS AND FRAMES

- A. Flush Access Doors and Trimless Frames: Fabricated from steel sheet.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Door: Minimum 0.060-inch- (1.5-mm-) thick sheet metal, set flush with surrounding finish surfaces.
 - 3. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with drywall bead.
 - 4. Hinges: Continuous piano hinge.
 - 5. Latch: Screwdriver-operated cam latch.

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. Exposed Flanges: Nominal 1 to 1-1/2 inches (25 to 38 mm) wide around perimeter of frame.
 - 2. Framing in Drywall Construction: Provide mounting holes in frames to attach frames to wood framing in drywall construction.
 - D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
- 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 metal fabrications after assembly.
- 2.7 STEEL FINISHES
- A. 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:
 - 1. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
 - B. Apply shop primer to uncoated surfaces of metal fabrications. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Advise installers of other work about specific requirements relating to access 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.

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.

END OF SECTION 08311

SECTION 08710 - FINISH HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Commercial door hardware for the following:
 - a. Swinging doors.
 - 2. Electrified door hardware.
- B. Related Sections include the following:
 - 1. Division 8 Section "Standard Steel Doors and Frames" for door silencers provided as part of hollow-metal frames.
 - 2. Division 16 Sections for connections to electrical power system and for low-voltage wiring work.
 - 3. Division 16 Sections for power supplies, battery backup, relays and timer control for electrified door hardware.

1.3 SUBMITTALS

- A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Details of electrified door hardware (rough-in only), indicating the following:
 - 1. Wiring Diagrams: For power, signal, and control wiring and including the following:
 - a. Details of interface of electrified door hardware and security systems.
 - b. Schematic diagram of systems that interface with electrified door hardware.
 - c. Point-to-point wiring.
 - d. Risers.
 - e. Elevations of doors controlled by electrified door hardware.
 - 2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

- C. Qualification Data: For Installer, Architectural Hardware Consultant.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for locks, latches, and closers.
- E. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.
- F. Warranty: Special warranty specified in this Section.
- G. Other Action Submittals:
 - 1. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
 - b. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, and material of each door and frame.
 - 2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
 - 3) Complete designations of every item required for each door or opening including name and manufacturer.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for door hardware.
 - 8) Door and frame sizes and materials.
 - 9) List of related door devices specified in other Sections for each door and frame.
 - c. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.
 - 2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

- H. Exterior Door Hardware products are to be listed in Florida Building Code Product Approval List. Contractor to provide Product Approval number(s).
- I. FLORIDA BUILDING CODE – WINDLOAD: Submit certified independent lab test report on each type of exterior opening. All exterior opening submittals shall include door number, door and frame elevations and all door hardware as tested as an assembly. These reports are to be forwarded to the building department. Provide eight copies.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.
 - 1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
 - 2. Installer shall have warehousing facilities in Project's vicinity.
 - 3. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
- C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
- D. Keying Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." In addition to Owner, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
 - 1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2. Preliminary key system schematic diagram.
 - 3. Requirements for key control system.
 - 4. Address for delivery of keys.
- E. Provide exterior door hardware that meets the windload test requirements in accordance with the Florida Building Code and are in compliance with the local authority having jurisdiction. All openings require to meet either the impact test or windload test as indicated by the architect shall be tested as systems with the door hardware, hollow metal doors and frames and installed in accordance with the applicable tests. These requirements take precedence over requirements for such hardware. Provide only hardware that has been tested and listed by local authority for

the types and sizes of doors required, and complies with the requirements of the door and door frame.

- F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.6 COORDINATION

- A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of operators and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: Three years from date of Substantial Completion, except as follows:
 - a. Exit Devices: Two years from date of Substantial Completion.
 - b. Manual Closers: 10 years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.
 - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.
 - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- C. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 HINGES, GENERAL

- A. Quantity: Provide the following, unless otherwise indicated:
 - 1. Two Hinges: For doors with heights up to 60 inches (1524 mm).
 - 2. Three Hinges: For doors with heights 61 to 90 inches (1549 to 2286 mm).
- B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- C. Hinge Weight: Unless otherwise indicated, provide the following:

1. Entrance Doors: Heavy-weight hinges.
 2. Doors with Closers: Antifriction-bearing hinges.
 3. Interior Doors: Standard-weight hinges.
- D. Hinge Base Metal: Unless otherwise indicated, provide the following:
1. Exterior Hinges: Stainless steel, with stainless-steel pin.
- E. Hinge Options: Where indicated in door hardware sets or on Drawings:
1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors and outswinging corridor doors with locks.
 2. Corners: Square.
- F. Fasteners: Comply with the following:
1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
 2. Screws: Phillips flat-head; machine screws (drilled and tapped holes) for metal doors. Finish screw heads to match surface of hinges.

2.3 HINGES

- A. Butts and Hinges: BHMA A156.1.
- B. Template Hinge Dimensions: BHMA A156.7.
- C. Available Manufacturers:
1. Hager Companies (HGR).
 2. Lawrence Brothers, Inc. (LB).
 3. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

2.4 LOCKS AND LATCHES, GENERAL

- A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and "Florida Building Code – 2007, Chapter 11, Florida Accessibility Code for Building Construction, Part A".
1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).
- B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

2.5 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
 - 2. Deadbolts: Minimum 1-inch (25-mm) bolt throw.
- C. Lock Backset: 2-3/4 inches (70 mm), unless otherwise indicated.
- D. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Yale Security Inc.; an ASSA ABLOY Group company.

2.6 AUXILIARY LOCKS

- A. Mortise Auxiliary Locks: BHMA A156.5; Grade 2; with strike that suits frame.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Falcon Lock; an Ingersoll-Rand Company (FAL).

2.7 DOOR BOLTS

- A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Half-Round Surface Bolts: Minimum 7/8-inch (22-mm) throw.
 - 2. Interlocking Surface Bolts: Minimum 15/16-inch (24-mm) throw.
- B. Dustproof Strikes: BHMA A156.16, Grade 1.
- C. Manual Flush Bolts: BHMA A156.16, Grade 1; designed for mortising into door edge.
 - 1. Available Manufacturers:
 - a. IVES Hardware; an Ingersoll-Rand Company (IVE).
 - b. Rockwood Manufacturing Company (RM).

2.8 ELECTRIFIED EXIT DEVICES

- A. Acceptable manufacturer; Yale 7100 Series Alum. Trim, subject to compliance with requirements, and complete assembly testing for the Florida Building Code windload requirements.

2.9 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
 - 1. Manufacturer: Sargent; LA Key System (6 pin).
- B. Standard Lock Cylinders: BHMA A156.5; Grade 2; permanent cores that are removable; face finished to match lockset.

2.10 KEYING

- A. Provide a construction master key system tied into the existing key system with visual key control as directed by the Owner. All locks are to be factory keyed and a bitting list provided to the Owner at project completion. Provide with 6 pins.

Furnish keys in the following quantities;

- 2 Change Keys per lock
- 3 Grand Master Keys
- 3 Construction Keys
- 20 Key blanks

- B. Send all permanent keys directly from the manufacturer to the Owner by registered mail.
- C. Use only the construction keys during construction.
- D. Upon Substantial Completion of the Work, as that date is established by the Architect/Engineer, void the construction key system and, in the presence of the Architect/Engineer, demonstrate that the specified keying system is operating properly.

2.11 OPERATING TRIM

- A. Standard: BHMA A156.6.
- B. Materials: Fabricate from stainless steel, unless otherwise indicated.
- C. Available Manufacturers:
 - 1. IVES Hardware; an Ingersoll-Rand Company (IVE).
 - 2. Rockwood Manufacturing Company (RM).

2.12 CLOSERS

- A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and "Florida Building Code – 2007, Chapter 11, Florida Accessibility Code for Building Construction, Part A".
 - 1. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
 - b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
- B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.
- C. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
- D. Surface Closers: BHMA A156.4, Grade 1. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.
 - 1. Available Manufacturers:
 - a. Corbin Russwin DC 6000 Series (C/R).
- E. Coordinators: BHMA A156.3.

2.13 PROTECTIVE TRIM UNITS

- A. Size: 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified in door hardware sets.
- B. Fasteners: Manufacturer's standard machine or self-tapping screws.
- C. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from the following material:
 - 1. Material: 0.050-inch- (1.3-mm-) thick stainless steel.
 - 2. Available Manufacturers:
 - a. IVES Hardware; an Ingersoll-Rand Company (IVE).
 - b. Rockwood Manufacturing Company (RM).

2.14 STOPS AND HOLDERS

- A. Stops and Bumpers: BHMA A156.16, Grade 1.
- B. Combination Overhead Stops and Holders: BHMA A156.8, Grade 1.
- C. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.
- D. Available Manufacturers:
 - 1. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
 - 2. Hager Companies (HAG).
 - 3. IVES Hardware; an Ingersoll-Rand Company (IVE).
 - 4. Rockwood Manufacturing Company (RM).

2.15 THRESHOLDS

- A. Standard: BHMA A156.21.
- B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and "Florida Building Code – 2007, Chapter 11, Florida Accessibility Code for Building Construction, Part A".
 - 1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
- C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch (13 mm) high.
- D. Available Manufacturers:
 - 1. National Guard Products (NGP).
 - 2. Pemko Manufacturing Co. (PEM).

2.16 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

- C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 2. Steel Machine or Wood Screws: For the following fire-rated applications:
 - a. Mortise hinges to doors.
 - b. Strike plates to frames.
 - c. Closers to doors and frames.
 3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:
 - a. Surface hinges to doors.
 - b. Closers to doors and frames.
 - c. Surface-mounted exit devices.
 4. Spacers or Sex Bolts: For through bolting of hollow-metal doors.

2.17 FINISHES

- A. Standard: BHMA A156.18, as indicated in door hardware sets.
- 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: Comply with DHI A115 Series.
 - 1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DOOR HARDWARE SETS

HW SET: 01

DOOR NUMBER:

001 003

EACH TO HAVE:

2	EA	HINGE	BB1191 4.5 X 4.5 NRP	630	HGR
1	EA	HINGE	PTH-2	630	YALE
1	EA	EXIT DEVICE	7130F-5-SAFE-36X 656F	626	YALE
1	EA	DEADBOLT	D271	630	FAL
1	EA	PULL (INSIDE)	8105-6	630	IVE
1	EA	CLOSER	DC 6210	689	C/R
1	EA	KICK PLATE	8" X 2" LDW	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	THRESHOLD	950V	AL	NGP

HW SET: 02

DOOR NUMBER:

002 005

EACH TO HAVE:

3	EA	HINGE	BB1191 4.5 X 4.5 NRP	630	HGR
1	EA	PULL	634F	630	YALE
1	EA	DEADBOLT	352	630	YALE
1	EA	KICK PLATE	8" X 2" LDW	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	THRESHOLD	950V	AL	NGP
1	EA	OVERHEAD HOLDER	450F	630	GLY

HW SET: 03
DOOR NUMBER:
004

EACH TO HAVE:

6	EA	HINGE	BB1191 4.5 X 4.5 NRP	630	IVE
1	EA	PULL	634F	630	YALE
1	EA	DEADBOLT	352	630	YALE
2	EA	MANUAL FLUSH BOLT	FB358	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	ASTRAGAL	BY DOOR SUPPLIER		B/O
2	EA	KICKPLATE	8" X 2" LDW	630	IVE
2	EA	SILENCER	SR64	GRY	IVE
1	EA	THRESHOLD	950V	AL	NGP
2	EA	OVERHEAD HOLDER	450F	630	GLY

END OF SECTION 08710

SECTION 09220 - PORTLAND CEMENT PLASTER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Exterior portland cement plasterwork (stucco) on metal lath and solid-plaster bases.
- B. Related Sections include the following:
 - 1. Division 4 Section "Unit Masonry Assemblies" for solid-plaster bases.
 - 2. Division 6 Section "Rough Carpentry" for wood framing and furring included in portland cement plaster assemblies.
 - 3. Division 7 Section "Joint Sealants" for acoustical sealants and sealants installed with exterior portland cement plaster (stucco).

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For portland cement plaster assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 PROJECT CONDITIONS

- A. Comply with ASTM C 926 requirements.
- B. Exterior Plasterwork:
 - 1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
 - 2. Apply plaster when ambient temperature is greater than 40 deg F (4.4 deg C).
 - 3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

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. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 METAL LATH

- A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
 - 1. Available Manufacturers:
 - a. Alabama Metal Industries Corporation (AMICO).
 - b. Dale/Incor.
 - c. Marino/Ware; Division of Ware Industries, Inc.
 - 2. Diamond-Mesh Lath: Self-furring.
 - a. Weight: 2.5 lb/sq. yd. (1.4 kg/sq. m).
 - 3. 3/8-Inch (9.5-mm) Rib Lath: 3.4 lb/sq. yd. (1.8 kg/sq. m).

2.3 ACCESSORIES

- A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

- B. Zinc and Zinc-Coated (Galvanized) Accessories:
 - 1. Available Manufacturers:
 - a. Alabama Metal Industries Corporation (AMICO).
 - b. Dale/Incor.
 - c. Dietrich Industries, Inc.
 - 2. Cornerbeads: Fabricated from zinc-coated (galvanized) steel.
 - a. Small nose cornerbead with expanded flanges; use unless otherwise indicated.
 - 3. Casing Beads: Fabricated from zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
 - 4. Control Joints: Fabricated from zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - 5. Expansion Joints: Fabricated from zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.

2.4 MISCELLANEOUS MATERIALS

- A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
- B. Bonding Compound: ASTM C 932.
- C. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.
- D. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2.5 PLASTER MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
 - 1. Color for Finish Coats: To be selected by Architect from manufacturer's full range.
- B. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
- C. Sand Aggregate: ASTM C 897.
 - 1. Color for Job-Mixed Finish Coats: To be selected by Architect from manufacturer's full range.

2.6 PLASTER MIXES

- A. General: Comply with ASTM C 926 for applications indicated.
- B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:
 - 1. Portland Cement Mixes:
 - a. Scratch Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material (sum of separate volumes of each component material).
 - b. Brown Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 parts lime. Use 3 to 5 parts aggregate per part of cementitious material (sum of separate volumes of each component material).
- C. Base-Coat Mixes for Use over Concrete Unit Masonry: Single base coats for two-coat plasterwork as follows:
 - 1. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material (sum of separate volumes of each component material).
- D. Job-Mixed Finish-Coat Mixes:
 - 1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material (sum of separate volumes of each component material).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Prepare solid-plaster bases that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

3.3 INSTALLATION, GENERAL

- A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
- B. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

3.4 INSTALLING METAL LATH

- A. Expanded-Metal Lath: Install according to ASTM C 1063.
 - 1. On Solid Surfaces, Not Otherwise Furred: Install self-furring diamond-mesh lath.
 - 2. Flat-Ceiling and Horizontal Framing: Install 3/8-inch (9.5-mm) rib lath lath.

3.5 INSTALLING ACCESSORIES

- A. Install according to ASTM C 1063 and at locations indicated on Drawings.
- B. Reinforcement for External Corners:
 - 1. Install lath-type external-corner reinforcement at exterior locations.
 - 2. Install cornerbead at exterior locations.
- C. Control Joints: Install control joints at locations indicated on Drawings.
 - 1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
 - a. Horizontal and other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).

3.6 PLASTER APPLICATION

- A. General: Comply with ASTM C 926.
 - 1. Do not deviate more than plus or minus 1/4 inch in 10 feet (6.4 mm in 3 m) from a true plane in finished plaster surfaces, as measured by a 10-foot (3-m) straightedge placed on surface.
 - 2. Grout hollow-metal frames, bases, and similar work occurring in plastered areas, with base-coat plaster material, before lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 6 inches (152 mm) at each jamb anchor.
 - 3. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground, unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
- B. Bonding Compound: Apply on unit masonry plaster bases.

- C. Plaster Finish Coats: Apply to provide float finish to match Architect's sample.

3.7 CUTTING AND PATCHING

- A. Cut, patch, replace, and repair plaster as necessary to accommodate other work and to restore cracks, dents, and imperfections. Repair or replace work to eliminate blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.8 CLEANING AND PROTECTION

- A. Remove temporary protection and enclosure of other work. Promptly remove plaster from doorframes, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 09220

SECTION 09260 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Interior gypsum wallboard.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for interior load-bearing and non-load-bearing wood studs and gypsum sheathing applied over wood framing.
 - 2. Division 7 Section "Building Insulation" for insulation installed in gypsum board assemblies.

1.3 DEFINITIONS

- A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.
- C. Samples: For the following products:
 - 1. Trim Accessories: Full-size sample in 12-inch (300-mm) long length for each trim accessory indicated.

1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in

assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory."

- B. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Gypsum Board and Related Products:
 - a. G-P Gypsum Corp.
 - b. National Gypsum Company.
 - c. United States Gypsum Co.

2.2 INTERIOR GYPSUM WALLBOARD

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Gypsum Wallboard: ASTM C 36.

1. Regular Type:
 - a. Thickness: 5/8-inch (15.9 mm).
 - b. Long Edges: Tapered.
 - c. Location: As indicated.
2. Type X:
 - a. Thickness: 5/8 inch (15.9 mm).
 - b. Long Edges: Tapered.
 - c. Location: Where required for fire-resistance-rated assembly.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
 - a. Cornerbead: Use at outside corners.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
 - c. L-Bead: L-shaped; exposed long leg receives joint compound; use where indicated.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound; use at exposed panel edges.
 - e. Expansion (Control) Joint: Use where indicated.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

2.5 ACOUSTICAL SEALANT

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
 - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
- B. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - 1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Thermal Insulation: As specified in Division 7 Section "Building Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

- B. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Attach gypsum panels to framing provided at openings and cutouts.
- F. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members using resilient channels, or provide control joints to counteract wood shrinkage.
- G. Form control and expansion joints with space between edges of adjoining gypsum panels.
- H. Floating Construction: Where feasible, including where recommended in writing by manufacturer, install gypsum panels over wood framing, with floating internal corner construction.
- I. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
 - 1. Space screws a maximum of 12 inches (304.8 mm) o.c. for vertical applications.

3.3 PANEL APPLICATION METHODS

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
- B. Single-Layer Fastening Methods: Apply gypsum panels to studs with nails or screws.

3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.5 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
 - 1. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated. Standard exposed finish.

3.6 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
 - 1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
 - 2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
 - a. Installation of 80 percent of lighting fixtures, powered for operation.
 - b. Installation, insulation, and leak and pressure testing of water piping systems.
 - c. Installation of air-duct systems.
 - d. Installation of air devices.
 - e. Installation of mechanical system control-air tubing.
 - f. Installation of ceiling support framing.

END OF SECTION 09260

SECTION 09310 - CERAMIC TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Ceramic mosaic tile.
 - 2. Glazed wall tile.
 - 3. Crack-suppression membrane for thin-set tile installations.
- B. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-Place Concrete" for monolithic slab finishes specified for tile substrates.
 - 2. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.3 DEFINITIONS

- A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.
- B. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.4 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 - 1. Level Surfaces: Minimum 0.6.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, 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 tile and grout indicated. Include Samples of accessories involving color selection.
- D. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.
 - 2. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches (300 mm) square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
 - 3. Full-size units of each type of trim and accessory for each color and finish required.
- E. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- F. Product Certificates: For each type of product, signed by product manufacturer.
- G. Qualification Data: For Installer.
- H. Material Test Reports: For each tile-setting and -grouting product.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
 - 1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
 - 1. Waterproofing.
 - 2. Joint sealants.

1.7 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 requirement in ANSI A137.1 for labeling sealed 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 avoided.
- D. Store liquid latexes and emulsion adhesives 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.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 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. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Basis-of-Design Product: The design for each tile type is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
 2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.
- C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
1. As selected by Architect from manufacturer's full range.
- D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
- F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE PRODUCTS

- A. Available Manufacturers:
1. American Olean; Div. of Dal-Tile International Corp.
 2. Ceramiche Keope.
 3. Crossville Ceramics Company, L.P.
 4. Daltile; Div. of Dal-Tile International Inc.
 5. Florida Tile Industries, Inc.
- B. Unglazed Ceramic Mosaic Tile CT-1: Factory-mounted flat tile as follows:
1. Composition: Vitreous or impervious natural clay or porcelain.
 2. Surface: Smooth, without abrasive admixture.
 3. Module Size: 2 by 2 inches (50.8 by 50.8 mm).
 4. Nominal Thickness: 1/4 inch (6.35 mm).
 5. Face: Pattern of design indicated, with cushion edges.
 6. Basis-of-Design Product: Daltile Mosaics Unglazed; Keystones; Price Group 1 & 2 or provide a comparable equal competitors' product for approval.

7. Color to be selected from approved submitted samples, by Architect.
 8. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Base Cove: Cove, module size 2 by 1 inch (50.8 by 25.4 mm).
 - b. External Corners for Thin-Set Mortar Installations: Surface bullnose, module size 2 by 1 inch (50.8 by 25.4 mm).
 - c. Internal Corners: Cove, module size 2 by 1 inch (50.8 by 25.4 mm).
- C. Glazed Ceramic Mosaic Wall Tile CT-2: Flat tile as follows:
1. Module Size: 2 by 2 inches (50.8 by 50.8 mm).
 2. Thickness: 1/4 inch (8 mm).
 3. Face: Plain with cushion edges.
 4. Finish: Semimat, clear glaze.
 5. Mounting: Factory back-mounted.
 6. Basis-of-Design Product: Daltile Mosaic Colorbody Porcelain; Keystones; Price Group 1 & 2 or a comparable equal competitors' product for approval.
 7. Color to be selected from approved submitted samples, by Architect.
- 2.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANES FOR THIN-SET TILE INSTALLATIONS
- A. General: Manufacturer's standard product that complies with ANSI A118.10, selected from the following.
- B. PVC-Sheet Product: Two layers of PVC sheet heat-fused together and to facings of bondable nonwoven polyester, for adhering to latex-portland cement mortar; 60 inches (1524 mm) wide by 0.040-inch (1.01-mm) nominal thickness.
1. Available Product: Compotite Corporation; Composeal Gold.
- C. Fabric-Reinforced, Modified-Bituminous-Sheet Product: Self-adhering SBS-modified-bituminous sheet with woven reinforcement facing for adhering to latex-portland cement mortar; 36 inches (914 mm) wide by 0.040-inch (1.01-mm) nominal thickness.
1. Available Product: National Applied Construction Products, Inc.; Strataflex.
- D. Fabric-Reinforced, Fluid-Applied Product: System consisting of liquid-latex rubber and fabric reinforcement.
1. Available Products:
 - a. LATICRETE International Inc.; Laticrete 9235 Waterproof Membrane.
 - b. MAPEI Corporation; PRP M19.
- E. Latex-Portland Cement Product: Flexible mortar consisting of cement-based mix and acrylic-latex additive.
1. Available Products:

- a. Boiardi Products Corporation; Elastiment 323.
- b. MAPEI Corporation; PRP 315.
- c. Southern Grouts & Mortars, Inc.; Southcrete 1100.

2.5 SETTING AND GROUTING MATERIALS

A. Available Manufacturers:

1. Bonsal, W. R., Company.
2. DAP, Inc.
3. Jamo Inc.
4. LATICRETE International Inc.
5. MAPEI Corporation.
6. Southern Grouts & Mortars, Inc.

B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:

1. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Project site.
 - a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.

C. Standard Sanded Cement Grout: ANSI A118.6, color as indicated, for joint widths 1/8-inch or wider.

D. Standard Unsanded Cement Grout: ANSI A118.6, color as indicated, for joint widths 1/8-inch or narrower.

2.6 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

- D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.

- 1. Available Products:

- a. Bonsal, W. R., Company; Grout Sealer.
- b. Jamo Inc.; Matte Finish Penetrating Sealer.
- c. MAPEI Corporation; KER 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
- d. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.

2.7 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
 - 2. 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 before installing tile.
 - 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

- B. Provide concrete substrates for tile floors installed with thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
 - 1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
 - 2. Remove protrusions, bumps, and ridges by sanding or grinding.
- C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

- F. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Locate joints in tile surfaces directly above joints in concrete substrates.
 - 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- G. Grout tile to comply with requirements of the following tile installation standards:
 - 1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.

3.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANE INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.
- B. Install crack-suppression membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.
- C. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 FLOOR TILE INSTALLATION

- A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.
 - 1. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
 - a. Tile floors in wet areas.
- B. Joint Widths: Install tile on floors with the following joint widths:
 - 1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
- C. Grout Sealer: Apply grout sealer to grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.6 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.
- B. Joint Widths: Install tile on walls with the following joint widths:
 - 1. Glazed Wall Tile: 1/16 inch (1.6 mm).

3.7 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove latex-portland cement grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. 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. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 - 3. 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.
- B. 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.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.8 FLOOR TILE INSTALLATION SCHEDULE

- A. Tile Installation: Interior floor installation on waterproof crack-suppression membrane over concrete; thin-set mortar; TCA F122 and ANSI A108.5.
 - 1. Tile Type: Unglazed floor tile CT-1.
 - 2. Thin-Set Mortar: Latex-portland cement mortar.
 - 3. Grout: Polymer-modified sanded grout.

3.9 WALL TILE INSTALLATION SCHEDULE

- A. Tile Installation: Interior wall installation over masonry; thin-set mortar; TCA W202.

1. Tile Type: Unglazed wall tile CT-2.
2. Thin-Set Mortar: Latex-portland cement mortar.
3. Grout: Polymer-modified unsanded grout.

END OF SECTION 09310

SECTION 09912 - PAINTING (PROFESSIONAL LINE PRODUCTS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This 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 these Specifications indicate 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 (including color coding), 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.
 - 1. Prefinished items include the following factory-finished components:
 - a. Architectural woodwork.
 - b. Finished mechanical and electrical equipment.
 - c. Light fixtures.
 - 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Foundation spaces.
 - b. Furred areas.
 - c. Ceiling plenums.
 - d. Pipe spaces.
 - e. Duct 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.

D. Related Sections include the following:

1. Division 8 Section "Steel Doors and Frames" for factory priming steel doors and frames.
2. Division 9 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.

1.3 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
 3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
 4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

- A. Product Data: For each paint system indicated. Include block fillers and primers.
1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

- B. Samples for Initial Selection: For each type of finish-coat material indicated.
 - 1. After color selection, Architect will furnish color chips for surfaces to be coated.
- C. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
 - 1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
 - 2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
- D. Qualification Data: For Applicator.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings 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.
- B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
 - 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

- A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).
- B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).
- C. Do not apply paint in snow, rain, fog, or mist; or when 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.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
 - 1. Quantity: Furnish Owner with an additional 3 percent, but not less than 1 gal. (3.8 L) or 1 case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.
- B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Benjamin Moore & Co. (Benjamin Moore).
 - 2. ICI Dulux Paint Centers (ICI Dulux Paints).
 - 3. PPG Industries, Inc. (Pittsburgh Paints).
 - 4. Sherwin-Williams Co. (Sherwin-Williams).

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Colors: As selected by Architect from manufacturer's full range.

2.3 CONCRETE UNIT MASONRY BLOCK FILLERS

- A. Concrete Unit Masonry Block Filler: Factory-formulated high-performance latex block fillers.
 - 1. Benjamin Moore; Moorcraft Super Craft Latex Block Filler No. 285: Applied at a dry film thickness of not less than 8.1 mils (0.206 mm).
 - 2. ICI Dulux Paints; Bloxfil 4000-1000 Interior/Exterior Heavy Duty Acrylic Block Filler: Applied at a dry film thickness of not less than 7.0 to 14.5 mils (0.178 to 0.368 mm).
 - 3. Pittsburgh Paints; 6-7 SpeedHide Interior/Exterior Masonry Latex Block Filler: Applied at a dry film thickness of not less than 6.0 to 12.5 mils (0.152 to 0.318 mm).
 - 4. Sherwin-Williams; PrepRite Interior/Exterior Block Filler B25W25: Applied at a dry film thickness of not less than 8.0 mils (0.203 mm).

2.4 EXTERIOR PRIMERS

- A. Exterior Concrete Masonry, and Stucco Primer: Factory-formulated alkali-resistant acrylic-latex primer for exterior application.
 - 1. Benjamin Moore; Moore's Acrylic Masonry Sealer No. 066: Applied at a dry film thickness of not less than 0.7 mils (0.018 mm).
 - 2. ICI Dulux Paints; 2000-1200 Dulux Professional Exterior 100 Percent Acrylic Latex Primer: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).
 - 3. Pittsburgh Paints; 6-603 SpeedHide Interior/Exterior Acrylic Latex Alkali Resistant Primer: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
 - 4. Sherwin-Williams; Loxon Exterior Masonry Acrylic Primer A24W300: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
- B. Exterior Ferrous-Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.
 - 1. Benjamin Moore; Moore's IMC Alkyd Metal Primer No. M06: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).

2. ICI Dulux Paints; 4160-XXXX Devguard Multi-Purpose Tank & Structural Primer. Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
 3. Pittsburgh Paints; 90-712 Pitt-Tech One Pack Interior/Exterior Primer Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
 4. Sherwin-Williams; Kem Kromik Universal Metal Primer B50NZ6/B50WZ1: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
- C. Exterior Galvanized Metal Primer: Factory-formulated galvanized metal primer for exterior application.
1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
 2. ICI Dulux Paints; 4020-XXXX Devflex DTM Flat Interior/Exterior Waterborne Primer & Finish: Applied at a dry film thickness of not less than 2.2 mils (0.056 mm).
 3. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
 4. Sherwin-Williams; Galvite HS Paint B50WZ3: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
- D. Exterior Aluminum Primer under Alkyd Finishes: Factory-formulated acrylic-based metal primer for exterior application.
1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
 2. ICI Dulux Paints; 4020-XXXX Devflex DTM Flat Interior/Exterior Waterborne Primer & Finish: Applied at a dry film thickness of not less than 2.2 mils (0.056 mm).
 3. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
 4. Sherwin-Williams; DTM Wash Primer B71Y1: Applied at a dry film thickness of not less than 2.5 mils (0.064 mm).

2.5 INTERIOR PRIMERS

- A. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.
1. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
 2. ICI Dulux Paints; 1030-1200 Ultra-Hide PVA Interior Primer Sealer General Purpose Wall Primer: Applied at a dry film thickness of not less than 1.9 mils (0.048 mm).
 3. Pittsburgh Paints; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
 4. Sherwin-Williams; PrepRite 200 Latex Wall Primer B28W200 Series: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).

- B. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer.
 - 1. Benjamin Moore; Moore's IMC Alkyd Metal Primer No. M06: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
 - 2. ICI Dulux Paints; 4130-6130 Devshield Rust Penetrating Metal Primer: Applied at a dry film thickness of not less than 2.2 mils (0.056 mm).
 - 3. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
 - 4. Sherwin-Williams; Kem Kromik Universal Metal Primer B50NZ6/B50WZ1: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
- C. Interior Zinc-Coated Metal Primer: Factory-formulated galvanized metal primer.
 - 1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
 - 2. ICI Dulux Paints; 4160-6130 Devguard Multi-Purpose Tank & Structural Primer: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
 - 3. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
 - 4. Sherwin-Williams; Galvite HS B50WZ30: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).

2.6 EXTERIOR FINISH COATS

- A. Exterior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for exterior application.
 - 1. Benjamin Moore; Moorcraft Super Spec Flat Latex House Paint No. 171: Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
 - 2. ICI Dulux Paints; 2200-XXXX Dulux Professional Exterior 100 Percent Acrylic Flat Finish: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
 - 3. Pittsburgh Paints; 6-600 Series SpeedHide Exterior House Paint Flat Latex: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).
 - 4. Sherwin-Williams; A-100 Exterior Latex Flat House & Trim Paint A6 Series: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).
- B. Exterior Semi-Gloss Acrylic Enamel: Factory-formulated semi-gloss acrylic enamel for exterior application.
 - 1. Benjamin Moore; Moorcraft Super Spec Latex House & Trim Paint No. 170: Applied at a dry film thickness of not less than 1.1 mils (0.028 mm).
 - 2. ICI Dulux Paints; 2406-XXXX Dulux Professional Exterior 100 Percent Acrylic Semi-Gloss Finish: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).
 - 3. Pittsburgh Paints; 6-900 Series SpeedHide Exterior House & Trim Semi-Gloss Acrylic Latex Paint: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).

4. Sherwin-Williams; A-100 Latex Gloss A8 Series: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).

2.7 INTERIOR FINISH COATS

- A. Interior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for interior application.
 1. Benjamin Moore; Moorecraft Super Spec Latex Flat No. 275: Applied at a dry film thickness of not less than 1.2 mils (0.031 mm).
 2. ICI Dulux Paints; 1200-XXXX Dulux Professional Velvet Matte Interior Flat Latex Wall & Trim Finish: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
 3. Pittsburgh Paints; 6-70 Line SpeedHide Interior Wall Flat-Latex Paint: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
 4. Sherwin-Williams; ProMar 200 Interior Latex Flat Wall Paint B30W200 Series: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
- B. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.
 1. Benjamin Moore; Moorcraft Super Spec Latex Eggshell Enamel No. 274: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).
 2. ICI Dulux Paints; 1402-XXXX Dulux Professional Acrylic Eggshell Interior Wall & Trim Enamel: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
 3. Pittsburgh Paints; 6-400 Series SpeedHide Eggshell Acrylic Latex Enamel: Applied at a dry film thickness of not less than 1.25 mils (0.032 mm).
 4. Sherwin-Williams; ProMar 200 Interior Latex Egg-Shell Enamel B20W200 Series: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).
- C. Interior Semigloss Acrylic Enamel: Factory-formulated semigloss acrylic-latex enamel for interior application.
 1. Benjamin Moore; Moorcraft Super Spec Latex Semi-Gloss Enamel No. 276: Applied at a dry film thickness of not less than 1.2 mils (0.031 mm).
 2. ICI Dulux Paints; 1406-XXXX Dulux Professional Acrylic Semi-Gloss Interior Wall & Trim Enamel: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
 3. Pittsburgh Paints; 6-500 Series SpeedHide Interior Semi-Gloss Latex: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
 4. Sherwin-Williams; ProMar 200 Interior Latex Semi-Gloss Enamel B31W200 Series: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).
- D. Interior Full-Gloss Epoxy: Factory-formulated two-package, full-gloss epoxy-polyamide coating for interior application.
 1. Benjamin Moore; IronClad Chemical & Water Resistant Epoxy Enamel (182): Applied at a dry film thickness of not less than 2.5 mils (0.063 mm).

2. ICI Dulux Paints; Devoe Tru-Glaze-WB 4408: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
3. Pittsburgh Paints; Aquapon 97 Line, 97-51 & 97-98: Applied at a dry film thickness of not less than 2 mils (0.051 mm).
4. Sherwin-Williams; Tile-Clad High Solids Epoxy B62Z-100 Series: Applied at a dry film thickness of not less than 2.5 mils (0.063 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.
 1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
- 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 ensure use of compatible primers.
 1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 1. Provide barrier coats over incompatible primers or remove and reprime.

2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
 - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
 3. Ferrous Metals: Clean ungalvanized 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 SSPC's recommendations.
 4. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.

2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 3. Provide finish coats that are compatible with primers used.
 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convactor covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 9. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 2. Omit primer over metal surfaces that have been shop primed and touchup painted.
 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
 2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
- F. Mechanical items to be painted include, but are not limited to, the following:
 - 1. Uninsulated metal piping.
 - 2. Uninsulated plastic piping.
 - 3. Pipe hangers and supports.
 - 4. Tanks that do not have factory-applied final finishes.
 - 5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - 6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
 - 7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
- G. Electrical items to be painted include, but are not limited to, the following:
 - 1. Switchgear.
 - 2. Panelboards.
 - 3. Electrical equipment that is indicated to have a factory-primed finish for field painting.
- H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

- A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:
 - 1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
 - 2. Testing agency will perform appropriate tests for the following characteristics as required by Owner:

- a. Salient characteristics to be tested are as follows: Abrasion resistance, accelerated weathering, alkali resistance, color retention, dry opacity, flexibility, and mildew resistance.
3. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
 1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 EXTERIOR PAINT SCHEDULE

- A. Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry): Provide the following finish systems over exterior concrete, stucco, and brick masonry substrates:
 1. Flat Acrylic Finish: Two finish coats over a primer.
 - a. Primer: Exterior concrete and masonry primer.
 - b. Finish Coats: Exterior flat acrylic paint.
- B. Concrete Unit Masonry: Provide the following finish systems over exterior concrete unit masonry:
 1. Flat Acrylic Finish: Two finish coats over a block filler.

- a. Block Filler: Concrete unit masonry block filler.
 - b. Finish Coats: Exterior flat acrylic paint.
- C. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
 - 1. Semigloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer.
 - a. Primer: Exterior ferrous-metal primer.
 - b. Finish Coats: Exterior semigloss acrylic enamel.
- D. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated metal surfaces:
 - 1. Semigloss Acrylic-Enamel Finish: Two finish coats over a galvanized metal primer.
 - a. Primer: Exterior galvanized metal primer.
 - b. Finish Coats: Exterior semigloss acrylic enamel.
- E. Aluminum: Provide the following finish systems over exterior aluminum surfaces:
 - 1. Semi-Gloss Acrylic-Enamel Finish: Two finish coats over a primer.
 - a. Primer: Exterior aluminum primer under acrylic finishes.
 - b. Finish Coats: Exterior semi-gloss acrylic enamel.

3.8 INTERIOR PAINT SCHEDULE

- A. Concrete Unit Masonry: Provide the following finish systems over interior concrete masonry:
 - 1. Semigloss Acrylic-Enamel Finish: Two finish coats over a block filler.
 - a. Block Filler: Concrete unit masonry block filler.
 - b. Finish Coats: Interior semigloss acrylic enamel.
 - 2. Epoxy Finish: Two finish coats over a block filler.
 - a. Block Filler: Concrete masonry unit block filler.
 - b. Finish Coats: Interior epoxy full-gloss coating.
- B. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
 - 1. Flat Acrylic Finish: Two finish coats over a primer.
 - a. Primer: Interior gypsum board primer.
 - b. Finish Coats: Interior flat acrylic paint.

2. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
 - a. Primer: Interior gypsum board primer.
 - b. Finish Coats: Interior semigloss acrylic enamel.
- C. Fiber-Cement Material: Provide the following finish systems over fiber-cement materials:
 1. Flat Acrylic Finish: Two finish coats.
 - a. Primer: Pre-primed.
 - b. Finish Coats: Interior flat acrylic paint.
- D. Ferrous Metal: Provide the following finish systems over ferrous metal:
 1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
 - a. Primer: Interior ferrous-metal primer.
 - b. Finish Coats: Interior semigloss acrylic enamel.
- E. Zinc-Coated Metal: Provide the following finish systems over interior zinc-coated metal surfaces:
 1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
 - a. Primer: Interior zinc-coated metal primer.
 - b. Finish Coats: Interior semigloss acrylic enamel.

END OF SECTION 09912

SECTION 10431 - SIGNS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Panel signs.
 - 2. Signage accessories.
- B. Related Sections include the following:
 - 1. Division 15 Section "Mechanical Identification" for labels, tags, and nameplates for mechanical equipment.
 - 2. Division 16 Section "Electrical Identification" for labels, tags, and nameplates for electrical equipment.

1.3 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, grounds, 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. Qualification Data: For Installer.
- E. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative of signage manufacturer for installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain each sign type through one source from a single manufacturer.
- C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.
 - 1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:
 - a. Signs for Accessible Spaces: Florida Building Code 2001, Chapter 11, Section 11-4.30

1.5 PROJECT CONDITIONS

- A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

- A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.
 - 1. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Basis-of-Design Product: The design for each sign is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 PANEL SIGNS

- A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally.
- B. Basis-of-Design Product: Best Manufacturing Co.; HC200 ADA System, or comparable product.
 1. Color: As selected by Architect from manufacturer's full range.
- C. "MP" Plastic: two-color, scratch resistant, non-static, fire-retardant washable 3-ply melamine surface laminate with non-glare surface and phenolic core painted a contrasting color after artwork has been carved into surface for raised lettering and Braille. Jet-288 and Jet-388 correspond, respectively, to phenolic-backed photopolymer sheets with overall thicknesses of 0.120 and 0.160 inch (3 and 4 mm).
- D. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished to comply with the following requirements:
 1. Edge Condition: Square cut.
 2. Corner Condition: Square.
- E. Laminated Panels: Permanently laminate face panels to backing sheets of material; use manufacturer's standard process.
- F. Graphic Content and Style: Provide sign copy that complies with requirements indicated in the Sign Schedule on Drawings for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.
- G. 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.
 1. Panel Material: Opaque acrylic sheet.
 2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

2.3 PANEL SIGN TYPES

- A. Toilet Room Signs:
 1. Material: MP – melamine plastic laminate.
 2. Perimeter: Unframed.
 3. Copy: Raised.
 4. Character Style: Helvetica.
 5. Text: According to requirements in the ADA or of authorities having jurisdiction, whichever are more stringent.
 6. Message: Fixed.
 7. Sizes:
 - a. Sign: 6"x6" minimum
 - b. Character: Minimum 1-inch- (25-mm-) high characters.

8. Colors:

- a. To be selected from manufactures full range of colors

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.

2. Exposed Metal-Fastener Components, General:

- a. Fastener Heads: For nonstructural connections, use flathead screws and bolts with tamper-resistant one-way-head slots unless otherwise indicated.

- B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.5 FINISHES, GENERAL

- A. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within 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 and other conditions affecting performance of work.

- B. Verify that items, including anchor inserts, provided under other sections of Work are sized and located to accommodate signs.

- C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
 - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
- B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:
 - 1. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 10431

SECTION 10520 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Portable fire extinguishers.
 - 2. Mounting brackets for fire extinguishers.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.
 - 1. Fire Extinguishers: Include rating and classification.
- B. Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.
- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
2. Warranty Period: Six years from date of Substantial Completion.

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. Basis-of-Design Product: The design for each product is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 PORTABLE FIRE EXTINGUISHERS

- A. Basis-of-Design Product: The design for each product is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.
 1. Ansul Incorporated.
- B. Available Manufacturers:
 1. JL Industries, Inc.
 2. Larsen's Manufacturing Company.
 3. Potter Roemer; Div. of Smith Industries, Inc.
- C. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 1. Valves: Manufacturer's standard.
 2. Handles and Levers: Manufacturer's standard.
 3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- D. Multipurpose Dry-Chemical Type in Steel Container FEC: UL-rated 2-A:10-B:C, 5-lb (2.3-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

- A. Available Manufacturers:
 1. Ansul Incorporated.
 2. JL Industries, Inc.

3. Larsen's Manufacturing Company.
 4. Potter Roemer; Div. of Smith Industries, Inc.
- B. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
1. Color: Red.
- C. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 1. Remove and replace damaged, defective, or undercharged units.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
 1. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

3.3 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 10520

SECTION 10801 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Public-use washroom accessories.
 - 2. Underlavatory guards.
 - 3. Custodial accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Samples: For each accessory item to verify design, operation, and finish requirements.
 - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated on Drawings.
 - 2. Identify products using designations indicated on Drawings.
- D. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.
- B. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- C. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- D. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
 - 1. A & J Washroom Accessories, Inc.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.
 - 5. General Accessory Manufacturing Co. (GAMCO).
- B. Toilet Tissue (Roll) Dispenser TPD: Owner Furnished, Owner Installed.
- C. Liquid-Soap Dispenser SD:
 - 1. Basis-of-Design Product: Bobrick #B-2111
 - 2. Description: Designed for dispensing soap in liquid or lotion form, operable with one hand and with less than 5 pounds of force.
 - 3. Mounting: Vertically oriented, surface mounted.
 - 4. Capacity: 40 fl. oz. (1180 mL).
 - 5. Materials: Stainless steel cover with satin finish and unbreakable clear acrylic refill-indicator window; molded plastic push button and spout; corrosion-resistant, soap head-holding mushroom valve; stainless steel spring.

6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

D. Grab Bar GB:

1. Basis-of-Design Product: Bobrick #B-6897.99
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
 - a. Finish: Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches (38 mm).
5. Configuration and Length: "L"; 42-inches wide x 54-inches deep.

E. Grab Bar GB (in lieu of Grab Bar specified above):

1. Basis-of-Design Product: Bobrick #B-6806.99
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
 - a. Finish: Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches (38 mm).
Configuration and Length: As indicated on Drawings.

F. Sanitary-Napkin Disposal Unit SND:

1. Basis-of-Design Product: Bobrick #B-254.
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing disposal-opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel with satin finish.

G. Mirror Unit MIR:

1. Basis-of-Design Product: Bobrick #B-2906.
2. Material: 22-gauge (0.8mm), type 430 stainless steel with bright polished finish.
3. Mounting: Exposed, tamper-resistant screws with finishing washers.
4. Size: 2'-0" x 3'-0"

2.3 WARM-AIR DRYERS

A. Warm-Air Dryer:

1. Basis-of-Design Product: American Dryer, Inc; ExtremeAir EXT2-M.
2. Mounting: Surface mounted.

3. Operation: Electronic-sensor activated with timed power cut-off switch.
 - a. Operation Time: Up to 80 seconds.
4. Cover Material and Finish: 18-gauge steel, with white epoxy finish.
5. Electrical Requirements: 115 V, 4.5 A, 540 W.

2.4 UNDERLAVATORY GUARDS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Plumberex Specialty Products, Inc.
 2. TCI Products.
 3. Truebro, Inc.
- B. Underlavatory Guard UG:
 1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping, and allow service access without removing coverings.
 2. Material and Finish: Antimicrobial, molded-plastic, white.

2.5 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10801

SECTION 11490 – PLAYGROUND AND TRACK EQUIPMENT

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. Basketball equipment.
 - 2. Track equipment
- B. Related Requirements:
 - 1. Section 03300 "Cast-in-Place Concrete"

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. If applicable, include assembly, disassembly, and storage instructions for removable equipment.
- B. Shop Drawings: For equipment.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include details of field assembly for removable equipment, connections, installation, mountings, inserts, attachments to other work, and operational clearances.
 - 3. Include transport and storage accessories for removable equipment.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Court layout plans, drawn to scale, and coordinated with floor inserts, game lines, and markers applied to finished flooring.
- B. Qualification Data: For Installer.
- C. Product Certificates: For each type of gymnasium equipment.
- D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For equipment to include in emergency, operation, and maintenance manuals.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of equipment that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Basketball backboard failures.
 - b. Track equipment failures.
 - 2. Warranty Period: Manufacturer's standard warranty, but in no case less than one year.

PART 2 - PRODUCTS

2.1 BASKETBALL BACKBOARD EQUIPMENT

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products equal to Porter Athletic, Inc. Rock Solid System exterior basketball post/backboard/nylon-net model 00175320FL (meeting Florida wind load requirements), or comparable product by one of the following:
 - 1. AALCO Manufacturing.
 - 2. ADP Lemco.
 - 3. Arizona Courtlines, Inc.
 - 4. Bison, Inc.
 - 5. Douglas Industries, Inc.
 - 6. Draper, Inc.
 - 7. Institutional Products, Inc.
 - 8. Jaypro Sports Construction Group.
 - 9. L. A. Steelcraft.
 - 10. Performance Sports Systems; a Gared Holdings company.
 - 11. Schelde North America.
 - 12. Spalding Equipment.

2.2 TRACK EQUIPMENT

- A. Long/Triple Jump Take-Off Board; equal to Gill Athletics Take-Off Board System 441TS aluminum construction with a synthetic board.
- B. Shot Cage: equal to Gill Athletics Aluminum Shot Cage 8050, complete with net.

- C. Discus / Hammer Throw Cage: equal to Gill Athletics Aluminum Hammer/discus Cage 732100 complete with net.
- D. Vault Box: equal to Gill Athletics Aluminum Vault Box 502 and Lid (flush mount) 50202.
- E. Shot / Discus Circle and toeboard: equal to gill Athletics Aluminum Shot / Hammer Circle No. 372 with toeboard No. 364.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances and other conditions affecting performance of the Work.
 - 1. Verify critical dimensions.
 - 2. Examine supporting structure, grades, etc.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of equipment. Complete equipment field assembly where required.
- B. Unless otherwise indicated, install equipment after other finishing operations are completed.
- C. Permanently Placed Equipment and Components: Install rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; and in proper relation to adjacent construction.

3.3 CLEANING

- A. After completing equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.
- B. Replace equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 11490

SECTION 15005/MECHANICAL GENERAL1 GENERAL

- 1.1 The work covered by this division consists of providing all labor, equipment and materials and performing all operations necessary for the installation of the mechanical work as herein called for and shown on the drawings.
- 1.2 Related Documents:
 - 1.2.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
 - 1.2.2 This is a Basic Mechanical Requirements Section. Provisions of this section apply to work of all Division 15 sections.
 - 1.2.3 Review all other contract documents to be aware of conditions affecting work herein.
 - 1.2.4 Definitions:
 - 1.2.4.1 Provide: Furnish and install, complete and ready for intended use.
 - 1.2.4.2 Furnish: Supply and deliver to project site, ready for subsequent requirements.
 - 1.2.4.3 Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.
- 1.3 Permits and Fees: Contractor shall obtain all necessary permits, meters, and inspections required for his work and pay all fees and charges incidental thereto.
- 1.4 Verification of Owner's Data: Prior to commencing any work the Contractor shall satisfy himself as to the accuracy of all data as indicated in these plans and specifications and/or as provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, he shall immediately notify the Architect/Engineer in order that proper adjustments can be anticipated and ordered. Commencement by the Contractor of any work shall be held as an acceptance of the data by him after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions or inaccuracies of the said data.
- 1.5 Delivery and Storage of Materials: Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. All material shall be stored to provide protection from the weather and accidental damage.
- 1.6 Extent of work is indicated by the drawings, schedules, and the requirements of the specifications. Singular references shall not be constructed as requiring only one device if multiple devices are shown on the drawings or are required for proper system operation.

1.7 Field Measurements and Coordination:

- 1.7.1 The intent of the drawings and specifications is to obtain a complete and satisfactory installation. Separate divisional drawings and specifications shall not relieve the Contractor from full compliance of work indicated on any of the drawings or in any section of the specifications.
- 1.7.2 Verify all field dimensions and locations of equipment to insure close, neat fit with other trades' work. Make use of all contract documents and approved shop drawings to verify exact dimension and locations.
- 1.7.3 Coordinate work in this division in proper sequence to insure that the total work is completed within contract time schedule and with a minimum cutting and patching.
- 1.7.4 Locate all apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on mechanical drawings, be guided by architectural details and conditions existing at job and correlate this work with that of others.
- 1.7.5 Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings and passageways. Cut no structural members without written approval.
- 1.7.6 Carefully examine any existing conditions, piping, and premises. Compare drawings with existing conditions. Report any observed discrepancies. It shall be the Contractor's responsibility to properly coordinate the work and to identify problems in a timely manner. Written instructions will be issued to resolve discrepancies.
- 1.7.7 Because of the small scale of the drawings, it is not possible to indicate all offsets and fittings or to locate every accessory. Drawings are essentially diagrammatic. Study carefully the sizes and locations of structural members, wall and partition locations, trusses, and room dimensions and take actual measurements on the job. Locate piping, ductwork, equipment and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and for coordination with all trades. Contractor shall not order materials or perform work without such verification. No extra compensation will be allowed because field measurements vary from the dimensions on the drawings. If field measurements show that equipment or piping will not fit, the Architect/Engineer shall be consulted. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.

1.8 Guarantee:

- 1.8.1 The Contractor shall guarantee labor, materials and equipment for a period of one (1) year from Substantial Completion, or from Owner's occupancy, whichever is earlier. Contractor shall make good any defects and shall include all necessary adjustments to and replacement of defective items without expense to the Owner.
- 1.8.2 Owner reserves right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond nor relieving Contractor of his responsibilities during guarantee period.

1.9 Approval Submittals:

- 1.9.1 When approved, the submittal control log and submittals shall be an addition to the specifications herewith, and shall be of equal force in that no deviation will be permitted except with the approval of the Architect/Engineer.
- 1.9.1.1 Shop drawings, product literature, and other approval submittals will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions and Division 1 Specification sections and the following.
- 1.9.1.1.1 Submittals shall be properly organized in accordance with the approved submittal control log.
- 1.9.1.1.2 Submittals shall not include items from more than one specification section in the same submittal package unless approved in the submittal control log.
- 1.9.1.1.3 Submittals shall be properly identified by a cover sheet showing the project name, Architect and Engineer names, submittal control number, specification section, a list of products or item names with model numbers in the order they appear in the package, and spaces for approval stamps. A sample cover sheet is included at the end of this section.
- 1.9.1.1.4 Submittals shall have been reviewed and approved by the General Contractor (or Prime Contractor). Evidence of this review and approval shall be an "Approved" stamp with a signature and date on the cover sheet.
- 1.9.1.1.5 Submittals that include a series of fixtures or devices (such as plumbing fixtures or valves) shall be organized by the fixture number or valve type and be marked accordingly. Each fixture must include all items associated with that fixture regardless of whether or not those items are used on other fixtures.
- 1.9.1.1.6 The electrical design shown on the drawings supports the mechanical equipment basis of design specifications at the time of design. If mechanical equipment is submitted with different electrical requirements, it is the responsibility of the Contractor to resolve all required electrical design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electrical design on the mechanical submittal with a written statement that this change will be provided at no additional cost. Mechanical submittals made with no written reference to the electrical design will be presumed to work with the electrical design. Any corrections required will be at no additional cost.
- 1.9.2 If the shop drawings show variation from the requirements of contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variation in writing in his letter of transmittal and on the submittal cover sheet in order that, if acceptable, Contractor will not be relieved of the responsibility for executing the work in accordance with the contract.
- 1.9.3 Review of shop drawings, product literature, catalog data, or schedules shall not relieve the Contractor from responsibility for deviations from contract drawings or specifications, unless he has in writing called to the attention of the Architect/Engineer each such deviation in writing at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings, product literature, catalog data, or schedules. Any feature or function specified but not mentioned in the submittal shall be assumed to be included per the specification.

- 1.9.4 Submit shop drawings as called for in other sections after award of the contract and before any material is ordered or fabricated. Shop drawings shall consist of plans, sections, elevations and details to scale (not smaller than 1/4" per foot), with dimensions clearly showing the installation. Direct copies of small scale project drawings issued to the Contractor are not acceptable. Drawings shall take into account equipment furnished under other sections and shall show space allotted for it. Include construction details and materials.
- 1.10 Test Reports and Verification Submittals: Submit test reports, certifications and verification letters as called for in other sections. Contractor shall coordinate the required testing and documentation of system performance such that sufficient time exists to prepare the reports, submit the reports, review the reports and take corrective action within the scheduled contract time.
- 1.11 O&M Data Submittals: Submit Operation and Maintenance data as called for in other sections. When a copy of approval submittals is included in the O&M Manual, only the final "Approved" or "Approved as Noted" copy shall be used. Contractor shall organize these data in the O&M Manuals tabbed by specification number. Prepare O&M Manuals as required by Division 1 and as described herein. Submit manuals at the Substantial Completion inspection.
- 2 PRODUCTS
- 2.1 All materials shall be new or Owner-supplied reused as shown on the drawings, the best of their respective kinds, suitable for the conditions and duties imposed on them at the building and shall be of reputable manufacturers. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the following sections.
- 2.2 Equipment and Materials:
- 2.2.1 Shall be new and the most suitable grade for the purpose intended. Equipment furnished under this division shall be the product of a manufacturer regularly engaged in the manufacture of such items for a period of three years. Where practical, all of the components shall be products of a single manufacturer in order to provide proper coordination and responsibility. Where required, Contractor shall furnish proof of installation of similar units or equipment.
- 2.2.2 Each item of equipment shall bear a name plate showing the manufacturer's name, trade name, model number, serial number, ratings and other information necessary to fully identify it. This plate shall be permanently mounted in a prominent location and shall not be concealed, insulated or painted.
- 2.2.3 The label of the approving agency, such as UL, IBR, ASME, ARI, AMCA, by which a standard has been established for the particular item shall be in full view.
- 2.2.4 The equipment shall be essentially the standard product of a manufacturer regularly engaged in the production of such equipment and shall be a product of the manufacturer's latest design.
- 2.2.5 A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.

- 2.2.6 Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.
- 2.2.7 Materials and equipment are specified herein by a single or by multiple manufacturers to indicate quality, material and type of construction desired. Manufacturer's products shown on the drawings have been used as basis for design; it shall be the Contractor's responsibility to ascertain that alternate manufacturer's products, or the particular products of named manufacturers, meet the detailed specifications and that size and arrangement of equipment are suitable for installation.
- 2.2.8 Model Numbers: Catalog numbers and model numbers indicated in the drawings and specifications are used as a guide in the selection of the equipment and are only listed for the contractor's convenience. The contractor shall determine the actual model numbers for ordering materials in accordance with the written description of each item and with the intent of the drawings and specifications.
- 2.3 Requests for Substitution:
- 2.3.1 Where a particular system, product or material is specified by name, consider it as standard basis for bidding, and base proposal on the particular system, product or material specified.
- 2.3.2 Requests by Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.
- 2.3.2.1 Required product cannot be supplied in time for compliance with Contract time requirements.
- 2.3.2.2 Required product is not acceptable to governing authority, or determined to be non-compatible, or cannot be properly coordinated, warranted or insured, or has other recognized disability as certified by Contractor.
- 2.3.2.3 Substantial cost advantage is offered Owner after deducting offsetting disadvantages including delays, additional compensation for redesign, investigation, evaluation and other necessary services and similar considerations.
- 2.3.3 All requests for substitution shall contain a "Comparison Schedule" and clearly and specifically indicate any and all differences or omissions between the product specified as the basis of design and the product proposed for substitution. Differences shall include but shall not be limited to data as follows for both the specified and substituted products:

Principal of operation.

Materials of construction or finishes.

Thickness of gauge of materials.

Weight of item.

Deleted features or items.

Added features or items.

Changes in other work caused by the substitution.

Performance curves.

If the approved substitution contains differences or omissions not specifically called to the attention of the Architect/Engineer, the Owner reserves the right to require equal or similar

features to be added to the substituted products (or to have the substituted products replaced) at the Contractor's expense.

3 EXECUTION

3.1 Workmanship: All materials and equipment shall be installed and completed in a first-class workmanlike manner and in accordance with the best modern methods and practice. Any materials installed which do not present an orderly and reasonably neat and/or workmanlike appearance, or do not allow adequate space for maintenance, shall be removed and replaced when so directed by the Architect/Engineer.

3.2 Coordination:

3.2.1 The Contractor shall be responsible for full coordination of the mechanical systems with shop drawings of the building construction so the proper openings and sleeves or supports are provided for piping, ductwork, or other equipment passing through slabs or walls.

3.2.2 Any additional steel supports required for the installation of any mechanical equipment, piping, or ductwork shall be furnished and installed under the section of the specifications requiring the additional supports.

3.2.3 It shall be the Contractor's responsibility to see that all equipment such as valves, dampers, filters and such other apparatus or equipment that may require maintenance and operation are made easily accessible, regardless of the diagrammatic location shown on the drawings.

3.2.4 All connections to fixtures and equipment shown on the drawings shall be considered diagrammatic unless otherwise indicated by detail. The actual connections shall be made to fully suit the requirements of each case and adequately provide for expansion and servicing.

3.2.5 The Contractor shall protect equipment, material, and fixtures at all times. He shall replace all equipment, material, and fixtures which are damaged as a result of inadequate protection.

3.2.6 Prior to starting and during progress of work, examine work and materials installed by others as they apply to work in this division. Report conditions which will prevent satisfactory installation.

3.2.7 Start of work will be construed as acceptance of suitability of work of others.

3.3 Interruption of Service: Before any equipment is shut down for disconnecting or tie-ins, arrangements shall be made with the Architect/Engineer and this work shall be done at the time best suited to the Owner. This will typically be on weekends and/or holidays and/or after normal working hours. Services shall be restored the same day unless prior arrangements are made. All overtime or premium costs associated with this work shall be included in the base bid.

3.4 Phasing: Provide all required temporary valves, piping, ductwork, equipment and devices as required. Maintain temporary services to areas as required. Remove all temporary material and equipment on completion of work unless Engineer concurs that such material and equipment would be beneficial to the Owner on a permanent basis.

- 3.5 Cutting and Patching: Contractor shall provide all cutting and patching of all holes, chases, sleeves, and other openings required for installation of equipment furnished and installed under this section. Utilize experienced trades for cutting and patching. Obtain permission from Architect/Engineer before cutting any structural items.
- 3.6 Equipment Setting: Bolt equipment directly to concrete pads or vibration isolators as required, using hot-dipped galvanized anchor bolts, nuts and washers. Level equipment.
- 3.7 Painting: Touch-up factory finishes on equipment located inside and outside shall be done under Division 15. Obtain matched color coatings from the manufacturer and apply as directed. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required.
- 3.8 Clean-up: Thoroughly clean all exposed parts of apparatus and equipment of cement, plaster, and other materials and remove all oil and grease spots. Repaint or touch up as required to look like new. During progress of work, contractor is to carefully clean up and leave premises and all portions of building free from debris and in a clean and safe condition.
- 3.9 Start-up and Operational Test: Start each item of equipment in strict accordance with the manufacturer's instructions; or where noted under equipment specification, start-up shall be done by a qualified representative of the manufacturer. Alignment, lubrication, safety, and operating control shall be included in start-up check.
- 3.10 Record (As Built) Drawings:
- 3.10.1 During the progress of the work the Contractor shall record on their field set of drawings the exact location, as installed, of all piping, ductwork, equipment, and other systems which are not installed exactly as shown on the contract drawings.
- 3.10.2 Upon completion of the work, record drawings shall be prepared as described in the General Conditions, Supplementary Conditions, and Division 1 sections.
- 3.11 Acceptance:
- 3.11.1 Punch List: Submit written confirmation that all punch lists have been checked and the required work completed.
- 3.11.2 Instructions: At completion of the work, provide a competent and experienced person who is thoroughly familiar with project, for one day to instruct permanent operating personnel in operation of equipment and control systems. This is in addition to any specific equipment operation and maintenance training.
- 3.11.3 Operation and Maintenance Manuals: Furnish four complete manuals bound in ring binders with Table of Contents, organized, and tabbed by specification section. Manuals shall contain:
- Detailed operating instructions and instructions for making minor adjustments.
Complete wiring and control diagrams.
Routine maintenance operations.

- Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.
 - Copies of approved submittals.
 - Copies of all manufacturer's warranties.
 - Copies of test reports and verification submittals.
- 3.11.4 Record Drawings: Submit record drawings.
- 3.11.5 Test and Balance Report: Submit four certified copies. The Report shall be submitted for review prior to the Substantial Completion Inspection unless otherwise required by Division 1.
- 3.11.6 Acceptance will be made on the basis of tests and inspections of job. A representative of firm that performed test and balance work shall be in attendance to assist. Contractor shall furnish necessary mechanics to operate system, make any necessary adjustments and assist with final inspection.

PROJECT NAME
PROJECT NUMBER

**This is a sample cover sheet. Use
one for each shop drawing.**

ARCHITECT/ENGINEER: Moses & Associates, Inc.

CONTRACTOR: XYZ Construction

SUBCONTRACTOR: ABC Mechanical Contractor

SUPPLIER: Jones Supply Co.

MANUFACTURER: Various

DATE: 2/15/95

SECTION: 15545/Hydronic Specialties

1. Vent valves - Hoffman No. 62
2. In-line air separators - Bell & Gossett RL-4
3. Diaphragm type compression tanks - Bell & Gossett B-200
4. Pump suction diffusers - Bell & Gossett ED-3
5. Triple duty valves - Bell & Gossett 3D-4S
6. Shot feeders - J. Woods No. 2
7. Pressure relief valves - Watts No. 6
8. Pressure reducing valves - Bell & Gossett No. 7

List each item separately

**Typical - list mfr name
& model number**

Leave space after each individual item for M&A comments

**M&A will list
all comments
on this sheet
and will only
stamp
approvals on
this sheet**

**General Contractor's
APPROVAL stamp must
be on this sheet.**

END OF SECTION

SAMPLE

SECTION 15020/CODES AND STANDARDS1 GENERAL

- 1.1 The work covered by this division consists of providing all labor, equipment and materials and performing all operations necessary for the installation of the mechanical work as herein called for and shown on the drawings.
- 1.2 This is a Basic Mechanical Requirements section. Provisions of this section apply to work of all Division 15 sections.

2 CODES

- 2.1 All work under Division 15 shall be constructed in accordance with the codes listed herein. The design has been based on the requirements of these codes; and while it is not the responsibility of the Contractor to verify that all work called for complies with these codes, he shall be responsible for calling to the Architect/Engineer's attention any drawings or specifications that are not in conformance with these or other codes prior to ordering equipment or installing work.
- 2.2 Comply with regulations and codes of utility suppliers.
- 2.3 Where no specific method or form of construction is called for in the contract documents, the Contractor shall comply with code requirements when carrying out such work.
- 2.4 Where code conflict exists, generally the most restrictive requirement applies. Comply with current code edition, unless noted.
- 2.5 Additional codes or standards applying to a specific part of the work may be included in that section.
- 2.6 The following codes govern the work:
 - 2.6.1 Florida Building Code - Building - 2007 with 2009 amendments.
 - 2.6.2 Florida Building Code - Plumbing - 2007 with 2009 amendments.
 - 2.6.3 Florida Building Code - Mechanical - 2007 with 2009 amendments.
 - 2.6.4 National Electric Code (NFPA 70) - 2008.
 - 2.6.5 Life Safety Code (NFPA 101) - 2006 Florida Edition.
 - 2.6.6 Installation of Air Conditioning and Ventilation Systems (NFPA 90A) - 2002.

3 STANDARDS

All mechanical materials, installation and systems shall meet the requirements of the following standards, including the latest addenda and amendments, to the extent referenced:

- 3.1 Underwriters' Laboratories (UL)
- 3.2 American National Standards Institution (ANSI)
- 3.3 American Society of Testing Materials (ASTM)
- 3.4 National Fire Protection Association (NFPA)
- 3.5 National Electrical Manufacturers Association (NEMA)
- 3.6 Air Conditioning and Refrigeration Institute (ARI)
- 3.7 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- 3.8 American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
- 3.9 Air Movement and Control Association (AMCA)

END OF SECTION

SECTION 15030/MECHANICAL RELATED WORK1 DIVISION 1 - GENERAL REQUIREMENTS

- 1.1 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 This is a Basic Mechanical Requirements section. Provisions of this section apply to work of all Division 15 sections.
- 1.3 Coordinate all cutting and patching. Contractor shall review all cutting and patching required prior to bidding and shall coordinate installation.

2 DIVISION 4 - MASONRY

- 2.1 Refer to Division 4, Masonry for:
 - 2.1.1 Installation of wall louvers.
 - 2.1.2 Installation of access doors in walls.

3 DIVISION 5 - METALS

- 3.1 Refer to Division 5, Metals for:
 - 3.1.1 Framing openings for mechanical equipment.
- 3.2 The following is part of Division 15 work.
 - 3.2.1 Supports for mechanical work.

4 DIVISION 7 - THERMAL AND MOISTURE PROTECTION

- 4.1 Refer to Division 7, Thermal and Moisture Protection for:
 - 4.1.1 Installation of all roof curbs and roof supports for mechanical work.
 - 4.1.2 Caulking and waterproofing of all wall and roof mounted mechanical work.
 - 4.1.3 Providing all roof curbs and all vent flashing for metal roofs.
- 4.2 The following is part of Division 15 work, complying with the requirements of Division 7.
 - 4.2.1 Fire barrier penetration seals.

5 DIVISION 8 - DOORS AND WINDOWS

5.1 Refer to Division 8, Doors & Windows for:

5.1.1 Installation of all door grilles.

5.1.2 Providing all undercuts

6 DIVISION 9 - FINISHES

6.1 Refer to Division 9, Finishes for:

6.1.1 Painting exposed ductwork, piping, and equipment.

6.1.2 Painting structural metal and concrete for mechanical work.

6.1.3 Painting door grilles and access panels.

6.1.4 Painting color-coded mechanical work indicated for continuous painting. See color schedule in Division 15 section, "Mechanical Identification".

6.1.5 Installation of access doors in gypsum drywall.

6.2 Colors shall be selected by the Architect for all painting of exposed mechanical work in occupied spaces, unless specified herein. Do not paint insulated or jacketed surfaces.

6.3 Perform the following as part of Division 15 work:

6.3.1 Touch up painting of factory finishes.

6.3.2 Painting of all hangers.

7 DIVISION 16 - ELECTRICAL

7.1 Contractor shall coordinate the exact electrical requirements of all mechanical equipment being provided. Where approval submittals are required, this coordination shall be accomplished prior to making the submittals. The electrical design shown on the drawings supports the mechanical equipment basis of design. If mechanical equipment is submitted with different electrical requirements, it is the responsibility of the Contractor to resolve all required electrical design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electrical design on the mechanical submittal with a written statement that this design will be provided at no additional cost. Mechanical submittals made with no written reference to the electrical design will be presumed to work with the electrical design. Any corrections required will be at no additional cost.

7.2 Contractor shall provide all HVAC control wiring including the Building Automation System (BAS) sensors, alarms, and input/output signals and all relays, interlocks, warning lights, and control devices, complying with the requirements of Division 16.

- 7.3 Contractor shall provide disconnect switches, starters, and contactors for mechanical equipment under Division 16 unless specifically noted as being furnished as part of mechanical equipment.
- 7.4 Contractor shall provide all power wiring, raceway and devices, and make final electrical connections to all mechanical equipment, switches, starters, contactors, controllers, and similar equipment.

END OF SECTION

SECTION 15105/PIPES AND PIPE FITTINGS1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-15 Basic Mechanical Materials and Methods section, and is part of each Division-15 section making reference to pipes and pipe fittings specified herein.
- 1.3 Extent of pipes and pipe fittings required by this section is indicated on drawings and/or specified in other Division-15 sections.

2 PRODUCTS

- 2.1 Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards. All piping provided for a particular system shall be by the same manufacturer.
- 2.2 Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.
- 2.3 Piping Materials/Products:
 - 2.3.1 Soldering Materials:
 - 2.3.1.1 Tin-Antimony (95-5) Solder: ASTM B-32, Grade 95TA.
 - 2.3.1.2 Silver-Phosphorus Solder: ASTM B-32, Grade 96TS.
 - 2.3.2 Pipe Thread Tape: Teflon tape.
 - 2.3.3 Protective Coating: Koppers Bitumastic No. 505 or equal.
- 2.4 Copper Tube and Fittings:
 - 2.4.1 Copper Tube:
 - 2.4.1.1 Copper Tube: ASTM B88; Type K or L as indicated for each service; hard-drawn temper unless specifically noted as annealed.
 - 2.4.1.2 DWV Copper Tube: ASTM B306.

2.4.2 Fittings:

2.4.2.1 Wrought-Copper Solder-Joint Fittings: ANSI B16.22.

2.4.2.2 Copper Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

2.4.2.3 Wrought-Copper Solder-Joint Drainage Fittings: ANSI B16.29.

2.4.2.4 Cast-Copper Flared Tube Fittings: ANSI B16.26.

2.5 Plastic Pipes and Fittings:

2.5.1 Pipes:

2.5.1.1 PVC DWV Pipe: ASTM D-2665, Schedule 40.

2.5.2 Fittings:

2.5.2.1 PVC Solvent Cement: ASTM D-2564.

2.5.2.2 PVC DWV Socket: ASTM D-2665.

3 EXECUTION

3.1 Installation

3.1.1 General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance or replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings, not bushings. Align piping accurately at connections, within 1/16" misalignment tolerance.

3.1.2 Comply with ANSI B31 Code for Pressure Piping.

3.1.3 Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to ½" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation.

3.1.4 Concealed Piping: Unless specifically noted as "Exposed" on the drawings, conceal piping from view in finished and occupied spaces, by locating in column enclosures, chases, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except

- as indicated. Protect concealed piping from physical damage in accordance with the Florida Building Code - Plumbing.
- 3.1.5 Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical, communications, or data equipment spaces and enclosures unless shown. Install drip pan under piping that must run through electrical spaces.
- 3.1.5.1 Cut pipe from measurements taken at the site, not from drawings. Keep pipes free of contact with building construction and installed work.
- 3.2 Piping System Joints: Provide joints of the type indicated in each piping system.
- 3.2.1 Solder copper tube-and-fitting joints where indicated, in accordance with ASTM B 828. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply non-acid type solder flux to joint areas of both tubes and fittings in accordance with ASTM B 813. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Solder shall conform to ASTM B 32 and shall be lead free. Wipe excess solder from joint before it hardens.
- 3.2.2 Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed. Paint exposed threads to retard rusting.
- 3.2.3 Plastic Pipe Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards.
- 3.2.3.1 Solvent-cemented joints shall be made in accordance with ASTM D-2235 and ASTM F-402.
- 3.3 Piping Installation
- 3.3.1 Install piping to allow for expansion and contraction.
- 3.3.2 Isolate all copper tubing from steel and concrete by wrapping the pipe at the contact point, and for one inch on each side, with at least two layers of plastic electrical tape. Isolate all copper tubing installed in block walls with a continuous plastic sleeve.
- 3.3.3 Underground Piping:
- 3.3.3.1 Provide plastic tape markers over all underground piping. Provide copper wire over all underground plastic piping. Locate markers 18" above piping.
- 3.3.3.2 Coat the following underground (uninsulated) pipes with a heavy coat of bitumastic or provide an 8 mil polyvinyl sleeve: black steel pipe, galvanized steel pipe, copper tubing.

END OF SECTION

SECTION 15110/VALVES1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to the work of this section.
- 1.2 This section is a Division-15 Basic Materials and Methods section, and is part of each Division-15 section making reference to or requiring valves specified herein.
- 1.3 Extent of valves required by this section is indicated on drawings and/or specified in other Division-15 sections.
- 1.4 Quality Assurance:
 - 1.4.1 Valve Dimensions: For face-to-face and end-to-end dimensions of flanged or welding-end valve bodies, comply with ANSI B16.10.
 - 1.4.2 Valve Types: Provide valves of same type by same manufacturer.
- 1.5 Approval Submittals: When required by other Division-15 sections, submit product data, catalog cuts, specifications, and dimensioned drawings for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valves with Division-15 section using the valves, not as a separate submittal. For each valve, identify systems where the valve is intended for use.
 - 1.5.1 Ball Valves. Type BA.
- 1.6 O&M Data Submittals: Submit a copy of approval submittals. Submit installation instructions, maintenance data and spare parts lists for each type of valve. Include this data in the O&M Manual.

2 PRODUCTS

- 2.1 General: Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with specifications and installation requirements. Provide sizes as indicated, and connections which properly mate with pipe, tube, and equipment connections.
- 2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide valves of one of the producers listed for each valve type. The model numbers are listed for contractor's convenience only. In the case of a model number discrepancy, the written description shall govern.
- 2.4 Ball Valves:
 - 2.4.1 General: Select with port area equal to or greater than connecting pipe area, include seat ring designed to hold sealing material.
 - 2.4.2 Construction: Ball valves shall be rated for 150 psi saturated steam and 600 psi non-shock cold water. Pressure containing parts shall be constructed of ASTM B-584 alloy 844, or ASTM B-124 alloy 377. Valves shall be furnished with blow-out proof bottom loaded stem constructed of ASTM

B-371 alloy 694 or other approved low zinc material. Provide TFE packing, TFE thrust washer, chrome-plated ball and reinforced teflon seats. Valves 2" and smaller shall be full port design. Valves 2½" and larger shall be conventional port design. Stem extensions shall be furnished for use in insulated piping where insulation exceeds ½" thickness.

2.4.3 Comply with the following standards:

MSS SP-72. Ball Valves with Flanged or Butt Welding Ends for General Service.
MSS SP-110. Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

2.4.4 Types of ball (BA) valves:

- 1 Threaded Ends 2" and Smaller (BA1): Bronze two-piece full port body with adjustable stem packing. Nibco T-585-70. Apollo 77-100.
- 2 Soldered Ends 2" and Smaller (BA2): Bronze two-piece full port body with adjustable stem packing. Nibco S-585-70. Apollo 77-200.
- 3 Threaded Ends 1" and Smaller (BA3): Bronze two-piece full port body, UL listed (UL 842) for use with flammable liquids and LP gas. Nibco T-585-70-UL.
- 4 Threaded Ends 2" and Smaller (BA4): 175 WWP, bronze two-piece body, UL listed for fire protection service. Nibco KT-585-70-UL and KT-580-70-UL.
- 5 Threaded Ends 2" and Smaller (BA5): 400 WWP, bronze two-piece body, for fire protection service. Nibco KT-580.
- 6 Threaded Ends 2½" and Smaller (BA6): 300 WWP, bronze three-piece body, gear operator with handwheel, indicator flag, accepts tamper switch, for fire protection, UL listed. Nibco T-505-4 and G-505-4.
- 7 Flanged Ends 2½" and Larger (BA7): Class 150, carbon steel full bore two-piece body with adjustable stem packing. Nibco F515-CS series. Apollo 88-240.
- 8 Threaded Ends 3" and Smaller (BA8): Bronze three-piece full port body, with stainless steel ball and stem suitable for steam service. 600 WOG/ 150 SWP. Milwaukee BA-300 S or approved equal.

2.5 Valve Features:

2.5.1 General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by Installer for installation requirements. Comply with ANSI B31.1

2.5.2 Valve features specified or required shall comply with the following:

- 1 Threaded: Provide valve ends complying with ANSI B2.1.
- 2 Solder-Joint: Provide valve ends complying with ANSI B16.18.

- 3 Trim: Fabricate pressure-containing components of valve, including stems (shafts) and seats from brass or bronze materials, of standard alloy recognized in valve manufacturing industry unless otherwise specified.
- 4 Non-Metallic Disc: Provide non-metallic material selected for service indicated in accordance with manufacturer's published literature.
- 5 Renewable Seat: Design seat of valve with removable disc, and assemble valve so disc can be replaced when worn.
- 6 Extended Stem: Increase stem length by 2" minimum, to accommodate insulation applied over valve.

3 EXECUTION

3.1 Installation:

- 3.1.1 General: Install valves where required for proper operation of piping and equipment, including valves in branch lines to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward below horizontal plane.
- 3.1.2 Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.
- 3.1.3 Applications Subject to Corrosion: Do not install bronze valves and valve components in direct contact with steel, unless bronze and steel are separated by dielectric insulator.
- 3.1.4 Mechanical Actuators: Install mechanical actuators as recommended by valve manufacturer.
- 3.2 Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections:
 - 3.2.1 Tube Size 2" and Smaller: Threaded valves. Soldered-joint valves may also be used.
 - 3.2.2 Pipe Size 2" and Smaller: Threaded valves.
 - 3.2.3 Pipe Size 2½" and Larger: Flanged valves.
- 3.3 Non-Metallic Disc: Limit selection and installation of valves with non-metallic disc to locations indicated and where foreign material in piping system can be expected to prevent tight shutoff of metal seated valves.
- 3.4 Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

END OF SECTION

SECTION 15120/PIPING SPECIALTIES1 GENERAL

- 1.1 Drawings and general provisions of contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-15 Basic Mechanical Materials and Methods section, and is part of each Division-15 section making reference to or requiring piping specialties specified herein.

2 PRODUCTS

- 2.1 General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.
- 2.2 Escutcheons:
 - 2.2.1 General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.
 - 2.2.2 Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.
 - 2.2.3 Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.
- 2.3 Fabricated Piping Specialties:
 - 2.3.1 Drip Pans: Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2". Reinforce top, either by structural angles or by rolling top over 1/4" steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1" drain line connection.
 - 2.3.2 Pipe Sleeves: Provide pipe sleeves of one of the following:
 - 2.3.2.1 Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gages: 3" and smaller, 20 gage; 4" to 6" 16 gage; over 6", 14 gage.
 - 2.3.2.2 Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
 - 2.3.2.3 Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.

2.3.3 Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one of the following:

2.3.3.1 Caulking and Sealant: Provide foam or caulking and sealant compatible with piping materials used.

3 EXECUTION

3.1 Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.

3.2 Drip Pans: Locate drip pans under piping passing over or within 3' horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1" drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.

3.3 Pipe Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Architect/Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves 1/4" above level floor finish, and 3/4" above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.

3.3.1 Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings. Fill annular space with caulking or fire barrier sealant as required.

3.3.2 Install steel-pipe sleeves at floor penetrations. Fill annular space with caulking or fire barrier sealant as required.

3.3.3 Install iron-pipe sleeves at all foundation wall penetrations and at exterior penetrations; both above and below grade. Fill annular space with caulking or mechanical sleeve seals.

END OF SECTION

SECTION 15140/METERS AND GAUGES1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-15 Basic Mechanical Materials and Methods section, and is part of each Division-15 section making reference to or requiring meters and gauges specified herein.
- 1.3 Extent of meters and gauges required by this section is indicated on drawings and/or specified in other Division-15 sections.
- 1.4 UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.
- 1.5 ANSI and ISA Compliance: Comply with applicable portions of ANSI and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.
- 1.6 Approval Submittals:
 - 1.6.1 Product Data: When required by other Division-15 sections, submit manufacturer's technical product data for each type of meter and gauge. Submit with Division-15 section using meters and gauges, not as a separate submittal. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit for:
 - 1.6.1.1 Pressure gauges
- 1.7 O&M Data Submittals: Submit a copy of approval submittals. Submit calibration curves and operating instructions for each type of meter or gauge. Include this data in O&M Manual.

2 PRODUCTS

- 2.1 Acceptable Manufacturers (Pressure Gauges): Subject to compliance with requirements, Ashcroft, Ernst Gauge Company, Weksler, Marshalltown Instruments, Terice, Weiss Instruments, Wheatley, Fluidyne or approved equal.
- 2.2 Pressure Gauges:
 - 2.2.1 General: Provide pressure gauges of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.
 - 2.2.2 Type: General use, 1% accuracy, ANSI B40.1 grade A, phosphor bronze bourdon type, bottom connection.
 - 2.2.3 Case: Drawn steel or brass, glass lens, 4-½" diameter.
 - 2.2.4 Connector: Brass with ¼" male NPT.
 - 2.2.5 Scale: White coated aluminum with black scale.

2.2.6 Range: Select so that highest possible pressure does not exceed 75% of full scale.

2.3 Pressure Gauge Cocks:

2.3.1 General: Provide 1/4" ball valves for use as pressure gauge cocks.

2.3.2 Snubber: 1/4" brass bushing with corrosion resistance porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.

3 EXECUTION

3.1 Installation of Pressure Gauges:

3.1.1 General: Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position.

3.1.2 Locations: Install in the following locations, and elsewhere as indicated:

3.1.2.1 At water service inlet.

3.2 Adjusting And Cleaning:

3.2.1 Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

3.2.2 Cleaning: Clean windows of meters and gauges and factory-finished surfaces. Replace cracked or broken windows, repair any scratched or marred surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 15150/SUPPORTS, ANCHORS, AND SEALS1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-15 Basic Materials and Methods section, and is a part of each Division-15 section making reference to or requiring supports, anchors, and seals specified herein.
- 1.3 Extent of supports, anchors, and seals required by this section is indicated on drawings and/or specified in other Division-15 sections.
- 1.4 Code Compliance: Comply with applicable codes pertaining to product materials and installation of supports, anchors, and seals.
- 1.5 MSS Standard Compliance:
 - 1.5.1 Provide pipe hangers and supports of which materials, design, and manufacture comply with ANSI/MSS SP-58.
 - 1.5.2 Select and apply pipe hangers and supports, complying with MSS SP-69.
 - 1.5.3 Fabricate and install pipe hangers and supports, complying with MSS SP-89.
 - 1.5.4 Terminology used in this section is defined in MSS SP-90.
- 1.6 UL Compliance: Provide products which are Underwriters Laboratories listed.

2 PRODUCTS

- 2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide supports and hangers by Grinnel, Michigan Hanger Company, B-Line Systems, or approved equal.
- 2.2 Horizontal-Piping Hangers and Supports: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
 - 2.2.1 Adjustable Steel Clevises: MSS Type 1.
 - 2.2.2 Steel Double Bolt Pipe Clamps: MSS Type 3.
 - 2.2.3 Adjustable Steel Band Hangers: MSS Type 7.
 - 2.2.4 Steel Pipe Clamps: MSS Type 4.

- 2.3 Vertical-Piping Clamps: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
- 2.3.1 Two-Bolt Riser Clamps: MSS Type 8.
- 2.3.2 Four-Bolt Riser Clamps: MSS Type 42.
- 2.4 Hanger-Rod Attachments: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
- 2.4.1 Steel Turnbuckles: MSS Type 13.
- 2.4.2 Malleable Iron Sockets: MSS Type 16.
- 2.5 Building Attachments: Except as otherwise indicated, provide factory-fabricated building attachments complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods.
- 2.5.1 Center Beam Clamps: MSS Type 21.
- 2.5.2 C-Clamps: MSS Type 23.
- 2.5.3 Malleable Beam Clamps: MSS Type 30.
- 2.5.4 Side Beam Brackets: MSS Type 34.
- 2.5.5 Concrete Inserts: MSS Type 18.
- 2.6 Saddles and Shields: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
- 2.6.1 Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.
- 2.6.2 Protection Saddles: MSS Type 39; use with rollers, fill interior voids with segments of insulation matching adjoining insulation.

2.7 Miscellaneous Materials:

2.7.1 Metal Framing: Provide products complying with NEMA STD ML 1.

2.7.2 Steel Plates, Shapes and Bars: Provide products complying with ANSI/ASTM A 36.

2.7.3 Cement Grout: Portland cement (ANSI/ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ANSI/ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

3 EXECUTION

3.1 Preparation

3.1.1 Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.

3.1.2 Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, and installers of other work requiring coordination with work of this section for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.2 Installation of Building Attachments:

3.2.1 Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.2.2 In areas of work requiring attachments to existing concrete, use self drilling rod inserts, Phillips Drill Co., "Red-Head" or equal.

3.3 Installation of Hangers and Supports:

3.3.1 General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69, Florida Building Code-Plumbing and Mechanical, or as listed herein, whichever is most limiting. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

- 3.3.1.1 Horizontal steel pipe and copper tube 1 ½" diameter and smaller: support on 6 foot centers.
- 3.3.1.2 Horizontal steel pipe and copper tube over 1 ½" diameter: support on 10 foot centers.
- 3.3.1.3 Vertical steel pipe and copper tube: support at each floor.
- 3.3.1.4 PVC pipe: support in accordance with manufacturer's recommendations, but not less than 4 foot centers.
- 3.3.2 Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.
- 3.3.3 Paint all black steel hangers with black enamel. Galvanized steel and copper clad hangers do not require paint.
- 3.3.4 Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.
- 3.3.5 Provision for Movement:
 - 3.3.5.1 Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
 - 3.3.5.2 Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
 - 3.3.5.3 Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded.
 - 3.3.5.4 Sway Bracing: Provide rigid support sway bracing for all changes in direction greater than 45 degrees on piping 4" and larger.
- 3.3.6 Insulated Piping: Comply with the following installation requirements.
 - 3.3.6.1 Shields: Where low-compressive-strength insulation or vapor barriers are indicated, install coated protective shields.
 - 3.3.6.2 Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
- 3.4 Installation of Anchors:
 - 3.4.1 Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.
 - 3.4.2 Fabricate and install anchors by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

- 3.4.3 Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and elbows. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

END OF SECTION

SECTION 15160/MECHANICAL IDENTIFICATION1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-15 Basic Mechanical Materials and Methods section, and is part of each Division-15 section making reference to or requiring identification devices specified herein.
- 1.3 Extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division-15 sections.
- 1.4 Refer to Division-16 sections for identification requirements of electrical work; not work of this section. Refer to other Division-15 sections for identification requirements for controls; not work of this section.
- 1.5 Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

2 PRODUCTS

- 2.1 General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-15 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.
- 2.2 Painted Identification Materials
 - 2.2.1 Stencils: Standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications, but not less than 1-1/4" high letters for ductwork and not less than 3/4" high letters for access door signs and similar operational instructions.
 - 2.2.2 Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
 - 2.2.3 Identification Paint: Standard identification enamel.
- 2.3 Plastic Pipe Markers
 - 2.3.1 Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers.
 - 2.3.1.1 Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with name as shown or specified.

- 2.3.1.2 Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.
- 2.4 Valve Tags:
- 2.4.1 Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Provide 1-1/2" diameter tags, except as otherwise indicated.
- 2.4.2 Plastic Laminate Valve Tags: Provide manufacturer's standard 3/32" thick engraved plastic laminate valve tags, with piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Provide 1-1/2" square black tags with white lettering, except as otherwise indicated.
- 2.5 Engraved Plastic-Laminate Signs:
- 2.5.1 General: Provide engraving stock melamine plastic laminate, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
- 2.5.2 Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.
- 2.5.3 Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
- 2.6 Stamped Nameplates: Provide equipment manufacturer's standard stamped nameplates for motors, AHUs, pumps, etc.
- 3 EXECUTION
- 3.1 Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.
- 3.2 Piping System Identification:
- 3.2.1 General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
- 3.2.1.1 Plastic pipe markers.
- 3.2.1.2 Stenciled markers, black or white for best contrast.
- 3.2.2 Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces and exterior non-concealed locations.
- 3.2.2.1 Near each valve and control device.

- 3.2.2.2 Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
- 3.2.2.3 Near locations where pipes pass through walls, floors, ceilings, or enter non-accessible enclosures.
- 3.2.2.4 At access doors, manholes and similar access points which permit view of concealed piping.
- 3.2.2.5 Near major equipment items and other points of origination and termination.
- 3.2.2.6 Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
- 3.2.2.7 On piping above removable acoustical ceilings, except omit intermediately spaced markers.
- 3.3 Valve Identification: Provide coded valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. Coordinate code with operating instructions.
- 3.4 Mechanical Equipment Identification: Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device. Label shall indicate type of system and area served. Provide signs for the following general categories of equipment and operational devices:
 - 3.4.1 Gauges, thermometers and similar units.
 - 3.4.2 Fans.
- 3.5 Stamped Nameplates: Equipment manufacturers to provide standard stamped nameplates on all major equipment items such as motors, pumps, AHUs, etc. Where motors are hidden from view (within equipment casing, or otherwise not easily accessible, etc.), the equipment supplier shall furnish a duplicate motor data nameplate to be affixed to the equipment casing in an easily visible location, unless data is already included on the equipment nameplate.
- 3.6 Adjusting and Cleaning:
 - 3.6.1 Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

END OF SECTION

SECTION 15180/TESTING, CLEANING, AND STERILIZATION OF PIPING SYSTEMS1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-15 Basic Mechanical Materials and Methods section, and is part of each Division-15 section making reference to or requiring the testing and other procedures specified herein.
- 1.3 Notify the Architect/Engineer when system tests are ready to be witnessed at least 24 hours prior to the test.
- 1.4 All materials, test equipment, and devices required for cleaning, testing, sterilizing or purging shall be provided by the Contractor.

2 PRESSURE TESTS

- 2.1 General: Provide temporary equipment for testing, including pump and gauges. Test piping systems before insulation is installed wherever feasible, and remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with indicated medium and pressurize for indicated pressure and time.
- 2.2 Required test period is 2 hours.
- 2.3 No piping, fixtures, or equipment shall be concealed or covered until they have been tested. The contractor shall apply each test and ensure that it is satisfactory for the period specified before calling the Architect/Engineer to observe the test. Test shall be repeated upon request to the satisfaction of those making the inspection.
- 2.4 Observe each test section for leakage at the end of the test period. Test fails if leakage is observed or if pressure drop exceeds 5% of the test pressure.
- 2.5 Check of systems during application of test pressures should include visual check for water leakage and soap bubble or similar check for air and nitrogen leakage.
- 2.6 During heating and cooling cycles, linear expansion shall be checked at all elbows and expansion joints for proper clearance.
- 2.7 Repair piping systems sections which fail required piping test. Disassemble and re-install using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
- 2.8 Pressure Test Requirements:

- 2.8.1 Soil, Waste and Vent: Test all piping within the building with a 10 foot head of water. Test piping in sections so that all joints are tested. Provide test tees as required. A smoke test can be used at the Contractor's option.
- 2.8.2 Domestic Water Perform hydrostatic test on all piping within the building at twice the normal static pressure at service point, but not less than 100 psig. Once tested, flush out piping and leave under pressure of the supply main or 40 psig for the balance of the construction period.
- 3 CLEANING AND STERILIZATION
- 3.1 General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water or blowdown with air before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.
- 3.2 Flush and drain all water systems at least three times. Reverse flush systems from smallest piping to largest piping. Replace startup strainers with operating strainers.
- 3.3 Sterilization of Domestic Water Systems:
- 3.3.1 Prerequisites: All new cold water piping installed (complete), all fixtures connected, system flushed out, and system filled with water.
- 3.3.2 The shut off valve at the water main shall be closed, all fixture outlets opened slightly, and a sterilizing solution shall be introduced at a manifold connection installed by the Contractor at the meter.
- 3.3.3 The solution shall contain 50 parts per million of available chlorine. The chlorinating material shall be either liquid chlorine or calcium hypochlorite. The solution shall be allowed to stand in the system for at least eight hours after which the entire system shall be flushed.
- 3.3.4 After final flushing, all aerators shall be removed, cleaned, and reinstalled. After final flush the residual chlorine shall not exceed 0.2 parts per million.
- 3.3.5 The Architect/Engineer shall be notified 24 hours prior to the procedure so that it can be witnessed.
- 3.3.6 Provide sampling and certified report by an independent testing lab. Provide written Health Department approval of disinfection samples.

END OF SECTION

SECTION 15190/EXCAVATION & BACKFILL1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-15 Basic Mechanical Materials and Methods section, and is part of each Division-15 section making reference to or requiring excavation and backfill specified herein.
- 1.3 Existing Utilities: Underground utilities shown were taken from old drawings. The exact location of these utilities and irrigation branches and abandoned services are not known. Use extreme caution when excavating. Contact Physical Plant Division for more information on utility location.
- 1.4 Refer to other Division-15 sections and/or drawings for specific requirements of the particular piping system being installed. Where another Division-15 section or the drawings conflict with requirements of this section, the other Division-15 section or the drawings shall take precedence over the general requirements herein.
- 1.5 OSHA: Contractor employee worker protection for all trenching and excavation operations shall comply with 29 CFR 1926.650 Subpart P and all current OSHA requirements. Contractor shall also erect barriers, provide shoring and maintain excavations as required to protect the public and adjacent traffic.

2 PRODUCTS

- 2.1 Sand: Clean, hard, uncoated grains free from organic matter or other deleterious substances. Sand for backfill shall be of a grade equal to mortar sand.
- 2.2 Gravel: Clean, well graded hard stone or gravel, free from organic material. Size range to be from No. 4 screen retentions to 1".
- 2.3 Earth: Fill free of clay, muck, stones, wood, roots or rubbish.
- 2.4 Identification Tape: Polyethylene 6 inches wide, 3.5 mil solid core encased in a 1 mil thick protective plastic jacket continuously printed with "CAUTION" in large black letters and type of pipe below. Tape shall conform to APWA specifications.
- 2.5 Copper Identification Wire: 14-gauge, single conductor, type UF.

3 EXECUTION

- 3.1 Ditching and Excavation: Shall be performed by hand wherever there is a possibility of encountering obstacles or any existing utility lines of any nature whatsoever. Where clear and unobstructed areas are to be excavated, appropriate machine excavation methods may be employed. Avoid use of machine excavators within the limits of the building lines.

- 3.2 Bedding: Excavate to bottom grade of pipe to be installed, and shape bed of undisturbed earth to contour of pipe for a width of at least 50% of pipe diameter. If earth conditions necessitate excavation below grade of the pipe, such as due to the presence of clay, muck, or roots, subcut and bring bed up to proper elevation with clean, new sand (as described in paragraph 2.1), deposited in 6" layers and tamped. Notify Architect/Engineer if subcut exceeds 12", or if bed is of an unstable nature. In this case a 6" minimum layer of gravel will be required before sand bedding begins. Submit cost proposal if the earth conditions require subcut in excess of 12" or if gravel is required to achieve proper bedding.
- 3.3 Placing: Pipe shall be carefully handled into place. Avoid knocking loose soil from the banks of the trench into the pipe bed. Rig heavier sections with nylon slings in lieu of wire rope to avoid crushing or chipping. Pipe which is handled with insulation in place, coated pipe, and jacketed pipe shall have special handling slings as required to prevent damage to the material.
- 3.4 Backfilling: Deposit clean new sand (as described in paragraph 2.1) to 6" above the pipe and tamp. Then deposit sand or earth carefully in 6" layers, maintaining adequate side support, especially on nonferrous piping materials. Compact fill in 6" layers, using mechanical means, up to the top elevation of the pipe, and in 12" layers to rough or finish grade as required. Fine grade and restore surface to original condition.
- 3.5 Special: Excavations shall be installed and maintained in satisfactory condition during the progress of the work. Subsurface structures are to be constructed in adequately sized excavations. De-watering equipment shall be installed and properly maintained where required. Shoring shall be employed in the event of unstable soil condition, and in all cases where required by OSHA regulations and necessary to protect materials and personnel from injury.
- 3.6 Identification: Install identification tape directly above all underground piping, one tape for each pipe where multiple pipes are installed. Depth of tape shall be at least 6 inches below finished grade and 18" to 30" above buried pipe. Tape copper wire to non-metallic pipes.
- 3.7 Depth of Cover: Minimum cover for underground piping is 30 inches unless indicated otherwise.
- 3.8 Existing Pavement: Where new piping passes below existing streets, driveways, parking lots, or other paved areas, the pavement shall be saw cut. Backfill shall be compacted to 95% density and the pavement shall be patched to match existing pavement. Provide compaction tests and reports as required.

END OF SECTION

SECTION 15205/INSULATION FOR PLUMBING EQUIPMENT AND PIPING1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-15 Basic Mechanical Materials and Methods Sections apply to work of this section.
- 1.3 Approval Submittals:
 - 1.3.1 Product Data: Submit a producer's data sheets and installation instructions on each insulation system including insulation, coverings, adhesives, sealers, protective finishes, and other material recommended by the manufacturer for applications indicated. Submit for:
 - 1.3.1.1 Fiberglass pipe insulation
 - 1.3.1.2 Removable insulation cover.
- 1.4 O&M Data Submittals: Submit a copy of all approval submittals. Include in O&M Manual.

2 PRODUCTS

- 2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide insulation products by Armacell, Industrial Insulation Group, Johns Manville, Knauf, Owens Corning, Pittsburgh Corning, U.S. Rubber, or approved equal. All products shall be asbestos-free.
- 2.2 Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics, and adhesive) with a flame-spread rating of 25 or less, and a smoke-developed rating of 50 or less, as tested by ANSI/ASTM E84.
- 2.3 Pipe Insulation Materials:
 - 2.3.1 Fiberglass Pipe Insulation: ASTM C547, Class 1 unless otherwise indicated. (Preformed sleeving with white all-service jacket, suitable for temperatures up to 450°F)
 - 2.3.2 Staples, Bands, Wires, and Cement: As recommended by the insulation manufacturer for applications indicated.
 - 2.3.3 Adhesives, Sealers, Protective Finishes: Products recommended by the insulation manufacturer for the application indicated.
 - 2.3.4 Jackets: ASTM C921, Type I (vapor barrier) for piping below ambient temperature, Type II (vapor permeable) for piping above ambient temperature. Type I may be used for all piping at Installer's option.

3 EXECUTION

3.1 General:

- 3.1.1 Install thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.
- 3.1.2 Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.
- 3.1.3 Maintain integrity of vapor-barrier on insulation and protect it to prevent puncture and other damage. Label all insulation "ASBESTOS FREE".
- 3.1.4 Do not apply insulation to surfaces while they are hot or wet.
- 3.1.5 Do not install insulation until systems have been checked and found free of leaks. Surfaces shall be clean and dry before attempting to apply insulation. A professional insulator with adequate experience and ability shall install insulation.
- 3.1.6 Do not install insulation on pipe systems until acceptance tests have been completed except for flexible unicellular insulation. Do not install insulation until the building is "dried-in".

3.2 Fiberglass Pipe Insulation:

- 3.2.1 Insulate the following piping systems (indoor locations):
 - 3.2.1.1 Cold water pipe: 1 ½" thick.
- 3.2.2 Apply insulation to pipe with all side and end joints butted tightly. Seal longitudinal lap by pressurizing with plastic sealing tool. Apply 3 inch wide self sealing butt strips to joints between insulation sections. Insulate all fittings, flanges, valves and strainers with premolded insulation. Apply coat of insulating cement to fittings and wrap with glass cloth overlapping each wrap 1" and adjacent pipe 2". Finish with heavy coat of general purpose mastic. Premolded PVC covers may also be used, but no flexible inserts are allowed.
- 3.2.3 Provide hanger or pipe support shields of 16 gauge (minimum) galvanized steel over the insulation which extends halfway up the pipe insulation cover and at least 6" on each side of the hanger.
- 3.2.4 Omit insulation on exposed plumbing fixture runouts from faces of wall or floor to fixture; on unions, flanges, strainer blowoffs, flexible connections and expansion joints.

END OF SECTION

SECTION 15405/POTABLE WATER SYSTEM1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-15 Basic Mechanical Requirements and Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.3 Extent of potable water systems work, is indicated on drawings and schedules, and by requirements of this section.
- 1.4 Refer to appropriate Division-2 sections for exterior potable water system; not work of this section unless noted.
- 1.5 Insulation for potable water piping is specified in other Division-15 sections, and is included as work of this section. Insulation requirements include:
 - 1.5.1 Cold water piping.
- 1.6 Excavation and backfill required in conjunction with water piping is specified in other Division-15 sections, and is included as work of this section.
- 1.7 Code Compliance: Comply with applicable portions of Florida Building Code-Plumbing pertaining to selection and installation of plumbing materials and products. Comply with local utility requirements.
- 1.8 Approval Submittals:
 - 1.8.1 Product Data: Submit manufacturer's technical product data and installation instructions for:
 - 1.8.1.1 Valves
 - 1.8.1.2 Hose bibbs and wall hydrants.
 - 1.8.1.3 Water hammer arresters
 - 1.8.1.4 Meters and gauges
- 1.9 Test Reports and Verification Submittals:
 - 1.9.1 Disinfection: Submit report by Health Department.
- 1.10 O&M Data Submittals: Submit a copy of all approval submittals. Submit maintenance data and parts lists for valves. Include these data in O&M manual.

2 PRODUCTS

- 2.1 General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with Florida Building Code - Plumbing where applicable. Provide sizes and types matching pipe materials used in potable water systems. Where more than one type of materials or products is indicated, selection is Installer's option.
- 2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following listed for each item.
- 2.3 Identification: Provide identification complying with Division-15 Basic Mechanical Materials and Methods section "Mechanical Identification".
- 2.4 Pipes and Fittings: Provide pipes and pipe fittings complying with Division-15 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings", in accordance with the following listing:
- 2.4.1 Interior Water Piping:
- 2.4.1.1 Above Grade: Copper tube; Type L, hard-drawn temper; wrought-copper fittings, solder-joints.
- 2.4.1.2 Copper tube; Type L, hard-drawn temper; wrought-copper fittings, solder-joints.
- 2.4.2 Solder joints shall be made with 95-5 solder.
- 2.5 Piping Specialties: Provide piping specialties complying with Division-15 Basic Mechanical Materials and Methods section "Piping Specialties".
- 2.6 Supports and Anchors: Provide supports and anchors complying with Division-15 Basic Mechanical Materials and Methods section "Supports and Anchors".
- 2.7 Interior Valves: Provide valves complying with Division-15 Basic Mechanical Materials and Methods section "Valves", in accordance with the following listing:
- 2.7.1 Sectional and Shutoff Valves: BA1, BA2.
- 2.8 Hose Bibbs: Provide rough nickel plated hose bibbs with lock shield compression stop and removable handle, solid flange, female connection with ¾" male threaded hose end, and straight line type non-removable vacuum breaker with ¾" male threaded hose end. Acorn 8121 RCP or equal model by Woodford.
- 2.9 Non-freeze Wall Hydrants: Provide ¾" anti-syphon, non-freeze wall hydrant with bronze casing, satin bronze box, straight inlet connection, and integral vacuum breaker-backflow preventer, Wade W-8625 or approved equal.
- 2.10 Water Hammer Arresters: Provide bellows type water hammer arresters, stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201. Precision Plumbing Products, Josam, Zurn, Amtrol, Wade, Jay R. Smith, or approved equal.

2.11 Meters and Gauges: Provide meters and gauges complying with Division-15 Basic Mechanical Materials and Methods section "Meters and Gauges", in accordance with the following listing:

2.11.1 Pressure gauges

3 EXECUTION

3.1 General: Examine areas and conditions under which potable water systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 Install mechanical identification in accordance with Division-15 Basic Mechanical Materials and Methods section "Mechanical Identification".

3.3 Install water distribution piping in accordance with Division-15 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings".

3.3.1 Install piping with 1/32" per foot (1/4%) downward slope towards drain point.

3.3.2 Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

3.4 Install piping specialties in accordance with Division-15 Basic Mechanical Materials and Methods section "Piping Specialties".

3.5 Install supports and anchors in accordance with Division-15 Basic Mechanical Materials and Methods section "Supports and Anchors".

3.6 Install valves in accordance with Division-15 Basic Mechanical Materials and Methods section "Valves".

3.6.1 Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves two or more plumbing fixtures or equipment connections, and elsewhere as indicated.

3.6.2 Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.

3.7 Hose Bibbs and wall hydrant: Install on concealed piping where indicated with vacuum breaker. Provide shutoff valve at inlet. Mount 18 inches above grade or finished floor.

3.8 Install meters and gauges in accordance with Division-15 Basic Mechanical Materials and Methods section "Meters and Gauges".

3.9 Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Florida Building Code-Plumbing.

3.10 Install water hammer arresters in upright position, in locations and of sizes indicated in accordance with PDI Standard WH-201.

- 3.11 Install air chambers at each fixture (or group of fixtures if the farthest fixture is within 6 feet of an air chamber). Air chambers shall be 20 pipe diameters long, but in no case less than 12 inches long.
- 3.12 Piping Tests: Test, clean, and sterilize potable water piping in accordance with testing requirements of Division-15 Basic Mechanical Materials and Methods section "Testing, Cleaning, and Sterilization of Piping Systems".
- 3.13 O&M Training: Provide four hours in one session.

END OF SECTION

SECTION 15410/SOIL, WASTE AND VENT SYSTEM1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-15 Basic Mechanical Requirements and Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.3 Extent of soil waste and vent systems work is indicated on drawings and schedules, and by requirements of this section.
- 1.4 Refer to appropriate Division-2 sections for exterior sanitary sewer system required in conjunction with soil and waste systems; not work of this section.
- 1.5 Insulation for soil and waste systems is specified in other Division-15 sections, and is included as work of this section. Insulation requirements include:
 - 1.5.1 Horizontal or vertical above grade waste pipes receiving discharge from coolers, freezers or similar units to points of connection receiving waste from 4 or more fixtures.
- 1.6 Excavation and backfill required in conjunction with soil, waste and vent piping is specified in other Division-15 sections and is included as work of this section.
- 1.7 Refer to Division-7 section "Flashing and Sheet Metal" for flashings required in conjunction with soil and waste systems; not work of this section.
- 1.8 Code Compliance: Comply with applicable portions of Florida Building Code-Plumbing pertaining to plumbing materials, construction and installation of products. Comply with local utility requirements.
- 1.9 Approval Submittals:
 - 1.9.1 Product Data: Submit manufacturer's technical product data for:
 - 1.9.1.1 Cleanouts
- 1.10 O&M Data Submittals: Submit a copy of all approval submittals. Include these data in O&M manual.

2 PRODUCTS

- 2.1 General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in soil and waste systems. Where more than one type of materials or products is indicated, selection is Installer's option.

- 2.2 Underground-Type Plastic Line Marker: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide green tape with black printing reading "CAUTION SEWER LINE BURIED BELOW".
- 2.3 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following listed for each item.
- 2.4 Pipes and Fittings: Provide pipes and pipe fittings complying with Division-15 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings", in accordance with the following listing:
 - 2.4.1 Above Ground Soil, Waste, and Vent Piping:
 - 2.4.1.1 Copper tube; Type DWV; Cast-bronze fittings, drainage pattern, 50-50 solder-joint. Use for waste arms only. Connections to tapped cast iron fittings shall be made with C X MPT DWV soil pipe adapters. Connections to hub-cast iron fittings shall be made with C X SPIGOT DWV soil pipe adapters. Connections to no hub cast-iron fittings shall be made with C X NO HUB DWV soil pipe adapters.
 - 2.4.1.2 Polyvinyl chloride plastic pipe (PVC); Type DWV; PVC plastic type DWV socket-type fitting, solvent cement joints. Do not use in fire-rated assemblies or return air plenums.
 - 2.4.2 Underground Building Drain Piping (within 5 feet of the building):
 - 2.4.2.1 Pipe Size 6" and Smaller: Polyvinyl chloride sewer pipe (PVC); Type DWV; PVC plastic type DWV socket-type.
- 2.5 Pipe Specialties: Provide piping specialties complying with Division-15 Basic Materials and Methods section "Piping Specialties".
- 2.6 Supports and Anchors: Provide supports and anchors complying with Division-15 Basic Mechanical Materials and Methods section "Supports and Anchors".
- 2.7 Cleanouts: Provide factory-fabricated drainage piping products of size and type indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and governing regulations. Josam, Jay R. Smith, Wade, Zurn, Watts.
 - 2.7.1 Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1 countersunk head.
 - 2.7.2 Cleanout for PVC Systems:
 - 2.7.2.1 Floor Cleanouts: Cast-iron body with adjustable head, brass plug, and scoriated nick-brass cover. Furnish with carpet flange style for carpeted floors. Furnish with recessed cover for tile floors. Furnish with clamping ring for floors with membrane. Wade W-6030 hub outlet for push-on.
 - 2.7.2.2 Cleanouts in Piping: PVC cleanout adaptor with threaded PVC plug.

2.7.2.3 Wall Cleanouts: PVC cleanout adaptor with tapped, countersunk, threaded brass plug and round stainless steel access cover with screw. Wade W-840-R-75. Add same as above here.

2.7.2.4 Grade Cleanouts: PVC cleanout adaptor with countersunk, threaded brass plug. Wade W-8590-D plug. In sidewalks and other finished concrete, provide access cover frames with a non-tilting tractor cover. Wade W-7035-Z or equal.

3 EXECUTION

3.1 Examine substrates and conditions under which soil and waste systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 Piping Installation:

3.2.1 Install above grade soil and waste piping in accordance with Division-15 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings", and with Florida Building Code-Plumbing.

3.2.2 Install underground soil and waste pipes as indicated and in accordance with Florida Building Code-Plumbing. Lay underground piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Clean interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

3.2.3 Install building soil and vent piping pitched to drain at minimum slope of 1/4" per foot (2%) for piping 3" and smaller, and 1/8" per foot (1%) for piping 4" and larger.

3.3 Install piping specialties in accordance with Division-15 Basic Mechanical Materials and Methods section "Piping Specialties".

3.4 Install supports and anchors in accordance with Division-15 Basic Mechanical Materials and Methods section "Supports and Anchors".

3.5 Installation of Cleanouts: Install in above ground piping and building drain piping as indicated, as required by Florida Building Code-Plumbing; and at each change in direction of piping greater than 45°; at minimum intervals of 100'; and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.

3.5.1 Size: Cleanouts shall be full size up to 4". Piping over 4" shall have a reducing fitting to accommodate a 4" cleanout unless indicated otherwise on drawings.

3.5.2 Install cleanouts to allow adequate clearance for rodding. Cleanouts on piping 6" and smaller piping shall have a minimum of 18" clearance; cleanouts on piping 8" and larger shall have 36" clearance.

- 3.5.3 Protect all finished surfaces of cleanouts with a suitable adhesive covering until construction is completed.
- 3.5.4 Cleanouts to Grade: Provide an 18" x 18" x 8" thick concrete pad around the cleanout. Set the cleanout ferrule, adapter, or access cover frame in the concrete as required. The cleanout shall be extended to the finished grade. The concrete pad shall slope away from the cleanout in all directions approximately one inch. Cover pad with fill to finished grade.
- 3.5.5 Cleanouts in Paved Areas: Provide concrete pad similar to cleanout to grade and coordinate concrete depth at site with adjustable flange. Access cover frames are required.
- 3.6 Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.
- 3.7 Vent Flashing Sleeves: Install on stack passing through roof, secure to stack flashing in accordance with manufacturer's instructions. For metal roofs, sleeves and flashing are by Division-7.
- 3.8 Piping Runouts to Fixtures: Provide soil and waste piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated, but in no case smaller than required by Florida Building Code-Plumbing.
- 3.9 Test, clean, flush, and inspect soil and waste piping in accordance with requirements of Division-15 Basic Mechanical Materials and Methods section "Testing, Cleaning and Sterilization of Piping Systems".

END OF SECTION

SECTION 15430/PLUMBING FIXTURES, EQUIPMENT, TRIM & SCHEDULE1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-15 Basic Mechanical Requirements and Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.3 Extent of plumbing fixtures work required by this section is indicated on drawings and schedules, and by requirements of this section.
- 1.4 Codes and Standards:
 - 1.4.1 Plumbing Fixture Standards: Comply with applicable portions of Florida Building Code-Plumbing pertaining to materials and installation of plumbing fixtures.
 - 1.4.2 ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems.
 - 1.4.3 PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.
 - 1.4.4 ANSI Compliance: Construct and install barrier-free plumbing fixtures in accordance with ANSI Standard A117.1 "Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People".
- 1.5 Approval Submittals:
 - 1.5.1 Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, furnished specialties and accessories; and installation instructions. Submit manufacturer's assembly-type drawings indicating dimensions, roughing-in requirements, required clearances, and methods of assembly of components and anchorages. The submittal shall be organized by "fixture number" and each fixture package shall be so identified. Each fixture package shall include all of the required fitting and trim, even if such devices are used for more than one fixture.
- 1.6 O&M Data Submittals: Submit a copy of approval submittals. Submit maintenance data and parts lists for each type of plumbing fixture and accessory; including "trouble-shooting" maintenance guide. Include these data in O&M manual.
- 1.7 Handle plumbing fixtures carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.

2 PRODUCTS

- 2.1 General: Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture, provide trim, carrier, seats, and valves as specified. Where not specified, provide products as recommended by manufacturer, and as required for complete installation. Where more than one type is indicated, selection is Installer's option; but, all fixtures of same type must be furnished by single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.
- 2.2 Model Numbers: Basis of design model numbers of a particular manufacturer are listed in the fixture schedule as an aid to contractors. Where conflicts between the model number and the written description occur, the written description shall govern. Where acceptable manufacturers are listed, products are subject to compliance with requirements.
- 2.3 Materials:
- 2.3.1 Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting seam marks, roller marks, foundry sand holes, stains, decoloration, or other surface imperfections on finished units are not acceptable.
- 2.3.2 All fixtures shall be white vitreous china unless otherwise specifically noted. Where enameled iron fixtures are specified, they shall be furnished with acid resisting enamel.
- 2.3.3 Where fittings, trim and accessories are exposed or semi-exposed provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.
- 2.3.4 Stainless Steel Sheets: ASTM A 167, Type 302, hardest workable temper. Finish shall be No. 4, bright, directional polish on exposed surfaces.
- 2.3.5 Vitreous China: High quality, free from fire cracks, spots, blisters, pinholes and specks; glaze exposed surfaces, and test for crazing resistance in accordance with ASTM C 554.
- 2.4 Plumbing Fittings, Trim and Accessories:
- 2.4.1 Faucets: At locations where water is supplied (by automatic), provide commercial quality chrome-plated, cast-brass faucets, valves, or other dispensing devices, of type and size indicated, and as required to operate as indicated.
- 2.4.1.1 Automatic Faucets: Provide electronic sensor-operated faucets with 0.5 gpm vandal-resistant spray head. Set volume adjustment at 0.25 gallons per operation. Provide box-mounted, hard-wired transformer (120 VAC primary - 24 VAC secondary). All wiring and electrical connections shall be provided by Division - 16.
- 2.4.1.2 Aerators: Provide aerators of types approved by Health Department having jurisdiction.
- 2.4.1.3 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. American Standard, Zurn.

- 2.4.2 Stops: Provide chrome-plated brass, angle type, manual shutoff valves and 3/8" chrome-plated flexible supply pipes to permit fixture servicing without shutdown of water supply piping systems for all fixtures. Coordinate with fixture requirements.
- 2.4.2.1 Provide loose key stops.
- 2.4.2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. McGuire, or approved equal.
- 2.4.3 Waste Outlets: Provide removable P-traps, drains, waste arms, tailpieces and wastes-to-wall where drains are indicated for direct connection to drainage system for all fixtures unless otherwise noted. Provide drains, tailpieces and waste arms where indirect drains are indicated. Waste outlets shall be full size of fixture drain connection.
- 2.4.3.1 P-traps, wastes and drains of all types shall be 17-gauge.
- 2.4.3.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. McGuire, or approved equal.
- 2.4.4 Insulation Kit: Provide preformed flexible, vinyl insulation kits for hot and cold water supplies and for waste where indicated. True Bro Model #102 or approved equal.
- 2.4.5 Flush Valves: Provide quiet-flush, chrome-plated, cast-brass flush valves with vacuum breaker and screwdriver stop. Where handicap service is indicated, provide ADA compliant handles with the handle on the wide side of the stall.
- 2.4.5.1 Automatic Flush Valves: Provide self-adaptive, electronic, infrared-sensor operated flush valves with 24 volt solenoid operator and override button. Provide a box mounted, hard-wired transformer (120 VAC primary - 24 VAC secondary). Provide matching wall cover plates each with four vandal resistant screws. All wiring and electrical connections shall be provided by Division - 16.
- 2.4.5.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Zurn.
- 2.4.6 Carriers: Provide cast-iron short foot carriers for water closets, urinals, lavatories, drinking fountains of either graphitic gray iron, ductile iron, or malleable iron or steel as indicated. Coordinate with specific fixture requirements and conditions of the project.
- 2.4.6.1 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Josam, Wade, Zurn, J.R. Smith.
- 2.4.7 Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.
- 2.4.8 Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome-plated brass escutcheons with friction clips.

- 2.4.9 Comply with additional fixture requirements listed for each fixture and as required for a complete and functional system.
- 2.5 Water Closets:
- 2.5.1 General: Provide white china siphon jet type unless otherwise noted.
- 2.5.1.1 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. American Standard, Crane, Kohler, Eljer.
- 2.5.2 Fixture Seats: Provide white, heavy molded plastic fixture seats with stainless steel self-sustaining check hinges.
- 2.5.2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Bemis Mfg. Co., Beneke Corp., Church, Sperzel, Olsonite, Centaco.
- 2.5.3 Water Closet Schedule:
- 2.5.3.1 WC2 Handicap Floor-Mounted Flush Valve Water Closet: Provide floor-mounted elongated bowl water closet with 1½" top spud and automatic flush valve. Provide open front seat, less cover. Provide hard wired power converter.
- | | |
|-----------------------|----------------------------|
| Water Closet | American Standard 3043.102 |
| Seat | Sperzel 50-EWSSCH |
| Automatic Flush Valve | Sloan Royal 111 ES-S |
- 2.6 Urinals:
- 2.6.1 General: Provide white china siphon jet wall hung type and 2" outlet unless otherwise noted. Provide short foot carrier with top and bottom hanger plates.
- 2.6.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Kohler.
- 2.6.3 Urinal Schedule:
- 2.6.3.1 UR2 Handicap Waterless Urinal: Provide handicap height urinal.
- | | |
|--------|---------------|
| Urinal | Kohler K-4917 |
|--------|---------------|
- 2.7 Lavatories:
- 2.7.1 General: Provide white china lavatories.
- 2.7.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. American Standard, Crane, Kohler, Eljer.

2.7.3 Lavatory Schedule:

- 2.7.3.1 L4 Handicap Wall Hung Lavatory with Automatic Faucet: Provide handicap 20" x 18" wall hung lavatory with ADA compliant automatic hand-washing faucet with hard wire connection. Provide handicap type waste and grid drain. Provide insulation kit for supply and waste.

Lavatory	American Standard 0355.012
Faucet	Sloan ETF-600-B-EL154
Grid Drain	McGuire 155WC
Insulation Kit	Truebro Model 102

2.8 Drinking Fountains:

- 2.8.1 General: Provide 18-gauge stainless steel drinking fountain with the entire water system free of lead. Where handicap units are indicated, the bubbler and fountain shall be ADA compliant.

- 2.8.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Most Dependable Fountains.

2.8.3 Drinking Fountain Schedule:

- 2.8.3.1 DF1 handicap Drinking Fountain: Provide ADA compliant handicap wall-hung dual drinking fountains with vandal-resistant push bar control. Provide wall-plate.

Drinking Fountain	Most Dependable Fountains Model 475WM
-------------------	---------------------------------------

2.9 Showers:

- 2.9.1 General: Provide and install 14 gauge, Type 304 stainless steel with satin finish, Acorn penal ware, wall mounted shower head with push button. Provide 2.5 gpm flow control valve. See architectural drawings for mounting height.

Valve and Shower Head	Acorn 1743-3-MT-SW
-----------------------	--------------------

- 2.9.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Acorn.

3 EXECUTION

- 3.1 Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

- 3.2 Install plumbing fixtures of types indicated where shown and at indicated heights. Install in accordance with fixture manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Install in accordance with ADA and applicable handicap code requirements. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of Florida Building Code - Plumbing pertaining to installation of plumbing fixtures. Furnish templates for cut-outs in countertops. Coordinate exact fixture locations with countertop shop drawings.

- 3.3 Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement. Mount at heights shown on the drawings. Fixture heights are floor-to-rim distance. Fitting heights are to centerline.
- 3.4 Install stop valve in water supply to each fixture.
- 3.5 After fixtures are set, the crack between the fixture and wall shall be caulked with DAP silicone-based caulking, or approved equal.
- 3.6 Protect installed fixtures from damage during remainder of construction period.
- 3.7 Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.
- 3.8 Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect/Engineer. Remove cracked or dented units and replace with new units.
- 3.9 Clean plumbing fixtures, trim, aerators, and strainers of dirt and debris upon completion of installation.
- 3.10 Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow stream and specified gpm.
- 3.11 Adjust or replace washers to prevent leaks at faucets and stops.

END OF SECTION

SECTION 15810/FANS1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-15 Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.3 Extent of fan work required by this section as indicated on drawings and schedules, and by requirements of this section.
- 1.4 Coordination:
 - 1.4.1 Refer to Division-15 section "Testing, Adjusting, and Balancing" for balancing of fans.
 - 1.4.2 Refer to Division-15 HVAC control systems sections for control work required in conjunction with fans.
 - 1.4.3 Refer to Division-16 sections for power supply wiring from power source to power connection on fans. Division-16 work will include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.
- 1.5 Codes and Standards:
 - 1.5.1 AMCA Compliance: Provide fans which have been tested and rated in accordance with AMCA standards, and bear AMCA Certified Ratings Seal.
 - 1.5.2 UL Compliance: Provide fans which are listed by UL and have UL label affixed.
- 1.6 Approval Submittals:
 - 1.6.1 Product Data: Submit manufacturer's technical data for fans, including specifications, capacity ratings, dimensions, weights, materials, accessories furnished, and installation instructions. Submit assembly-type drawings showing unit dimensions, construction details, methods of assembly of components, and field connection details.
 - 1.6.1.1 Fans
- 1.7 O&M Data Submittals: Submit maintenance data and parts list for each type of fan, accessory, and control. Include these data, a copy of approved submittals, and wiring diagrams in O&M Manual.

2 PRODUCTS

- 2.1 General: Except as otherwise indicated, provide standard prefabricated fans of type and size indicated, modified as necessary to comply with requirements, and as required for complete installation. Provide accessories as listed in the schedule on the drawings and as described herein. Motors shall be high efficiency per Division-15 section "Motors".

- 2.2 Acceptable Manufacturers: Subject to compliance with requirements provide fans manufactured by Acme, Greenheck, Loren Cook, Penn, Twin City, Breidert or approved equal unless otherwise noted herein.
- 2.3 Centrifugal Ceiling Exhausters:
- 2.3.1 Fan Assembly: Provide steel housing, plastic or aluminum grille, backdraft damper, statically and dynamically balanced fan wheel, permanently lubricated motor with internal thermal overloads, vibration isolation and all required mounting hardware and brackets. Provide acoustically treated housing for all fans larger than 60 cfm. Mounting type shall be as indicated on the drawings or on the schedule.
- 2.3.2 Connectors: Provide adaptors, connectors, and eave elbows as required to connect fan discharges to outlets.
- 2.3.3 Outlets: Provide where shown on the drawings (or required by the installation) wall caps, vent caps, or roof jacks, each with birdscreen, to match fans and surrounding construction.
- 2.4 Fan Accessories and Features: Where indicated on the schedule or drawings provide accessories and features listed herein.
- 1 Belt drive: Belt drives shall include cast iron, variable pitch sheaves, heavy duty belts, and 1750 rpm motors. The drive shall be adjustable to plus or minus 20% of scheduled flow. Provide sheave changes as required to support TAB work in order to optimize system performance. Final sheave shall be fixed.
 - 2 Direct drive: Direct drives shall have multispeed motors or speed controllers to achieve scheduled flow.
 - 3 Curbs: Furnish 12 inch high, roofed over type, prefabricated aluminum curbs with treated wood nailer and 1-1/2" fire resistant fiberglass insulation sized to match the fans. For deck slopes of 1/4" per foot and more, fabricate curbs to form level top edge.
 - 4 Bird Screens: Provide bird screens of 1/2" mesh aluminum or galvanized steel hardware cloth.
 - 5 Backdraft Dampers: Provide where indicated aluminum louvered dampers with felt-edged blades and nylon bearings.
 - 6 Disconnect Switches: Provide factory installed local disconnecting means.
 - 7 Thermal Overloads: Provide internal thermal overloads.
 - 8 Speed Controller: Provide where indicated solid state speed controller for remote mounting.
 - 9 Motorized Dampers: Provide where indicated aluminum louvered dampers with felt-edged blades and nylon bearings with 120 volt motors wired to operate with the fan. Provide limit switch to prevent fan starting until damper is at least half open.

3 EXECUTION

- 3.1 General: Except as otherwise indicated or specified, install fans in accordance with manufacturer's installation instructions and recognized industry practices to insure that fans serve their intended function.
- 3.2 Coordinate fan work with work of roofing, walls, and ceilings as necessary for proper interfacing. Framing of openings, caulking, and curb installation is not work of this section.
- 3.3 Ductwork: Refer to Division-15 section "Ductwork". Connect ducts to fans in accordance with manufacturer's installation instructions. Provide flexible connections in ductwork at fans.
- 3.4 Roof Curbs: Furnish roof curbs to roofing Installer for Installation.
- 3.5 Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical Installer. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-16 sections. Verify proper rotation direction of fan wheels. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
- 3.6 Remove shipping bolts and temporary supports within fans. Adjust dampers for free operation.
- 3.7 Testing: After installation of fans has been completed, test each fan to demonstrate proper operation of units at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Provide sheave changes as required to balance at required conditions with minimum noise and energy use. Replace units which cannot be satisfactorily corrected. Coordinate with TAB procedure and provide variable pitched sheaves and final fixed sheave and belt assembly as required to optimize the exhaust possible to meet the specified flow.
- 3.8 Cleaning: Clean factory-finished surfaces. Remove all tar and soil. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 15840/HVAC METAL DUCTWORK1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-15 Basic Mechanical Materials and Methods Sections apply to work of this section.
- 1.3 Extent of HVAC metal ductwork is indicated on drawings and in schedules, and by requirements of this section.
- 1.4 Refer to other Division-15 sections for exterior insulation of metal ductwork.
- 1.5 Refer to other Division-15 sections for ductwork accessories.
- 1.6 Codes and Standards:
 - 1.6.1 SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork, unless otherwise noted.
 - 1.6.2 NFPA 90A Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".
- 1.7 Approval Submittals:
 - 1.7.1 Product Data: Submit manufacturer's technical product data and installation instructions for the following.
 - 1.7.1.1 Factory-fabricated ductwork
 - 1.7.1.2 Sealants
 - 1.7.1.3 Spin-in fittings
 - 1.7.1.4 Side take-off fittings
 - 1.7.2 Shop Drawings: Submit scaled layout drawings of HVAC metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between ductwork and proximate equipment. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.

2 PRODUCTS

- 2.1 Ductwork Materials:

- 2.1.1 Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.
- 2.1.2 Galvanized Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lockforming quality; with G 90 zinc coating in accordance with ASTM A 525; and mill phosphatized for exposed locations. Stamp gauge and manufacturer's identification on each sheet. Break sheets so that identification is exposed.
- 2.2 Miscellaneous Ductwork Materials:
 - 2.2.1 General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.
 - 2.2.2 Duct Sealant: Provide non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.
 - 2.2.3 Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
 - 2.2.4 Spin-in and Side Take-off Fittings: Provide round branch run-outs as follows.
 - 2.2.4.1 Exhaust air grille connections shall be straight sided with damper equal to Crown 724 or Flexmaster FLD.
 - 2.2.4.2 Where duct height does not permit the use of conical spin-in fittings, use low profile side take-off fittings equal to Crown 3300-DS or Flexmaster STOD-BO.
 - 2.2.5 Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15° change of direction per section. Unless specifically detailed otherwise, use 45° laterals and 45° elbows for branch takeoff connections. Where 90° branches are indicated, provide conical type tees.
- 2.3 Fabrication:
 - 2.3.1 Shop fabricate ductwork in 4, 8, 10 or 12-ft lengths, unless otherwise indicated or required to complete runs. Preassemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.
 - 2.3.2 Shop fabricate ductwork of gauges and reinforcement complying with SMACNA "HVAC Duct Construction Standards", except provide sealant at all joints. Exhaust duct shall be minimum 2" pressure class unless otherwise noted.
 - 2.3.3 Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1½ times associated duct width; and fabricate to include turning vanes in elbows where

- shorter radius is necessary. Limit angular tapers to 30° for contracting tapers and 20° for expanding tapers.
- 2.3.4 Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-15 section "Ductwork Accessories" for accessory requirements.
- 2.4 Factory-Fabricated Low Pressure Ductwork (Maximum 2" W.G.):
- 2.4.1 Material: Galvanized sheet steel complying with ASTM A 527, lockforming quality, with ASTM A 525, G90 zinc coating, mill phosphatized.
- 2.4.2 Gauge: 28-gauge minimum for round ducts and fittings, 4" through 8" diameter. 26-gauge minimum 9" through 14", 24-gauge minimum 15" through 26".
- 2.4.3 Elbows: One piece construction for 90° and 45° elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.
- 2.4.4 Divided Flow Fittings: 90° tees, constructed with saddle tap spot welded and bonded to duct fitting body.
- 2.4.5 Acceptable Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork by Semco Mfg., Inc. or United Sheet Metal Div., United McGill Corp, or approved equal.
- 3 EXECUTION
- 3.1 General: Examine areas and conditions under which HVAC metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
- 3.2 Installation Of Metal Ductwork:
- 3.2.1 General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5% leakage for systems rated 3" and under; 1% for systems rated over 3") and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.
- 3.2.2 Supports: Install concrete inserts for support of ductwork in coordination with formwork, as required to avoid delays in work. Install self-drilling screw anchors in prestressed concrete or existing work.
- 3.2.3 Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.
- 3.2.4 Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally. Avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or,

- if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to ½" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. In finished and occupied spaces, conceal ductwork from view by locating in mechanical shafts, hollow wall construction or above suspended ceilings, unless specifically noted as "Exposed". Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
- 3.2.5 Electrical Equipment Spaces: Do not route ductwork through transformer vaults or other electrical equipment spaces and enclosures.
- 3.2.6 Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on 4 sides by at least 1½". Fasten to duct and substrate. Where ducts pass through fire-rated floors, walls, or partitions, provide firestopping between duct and substrate.
- 3.2.7 Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
- 3.2.8 Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards. Fan discharge outlet ducts shall be installed correctly with regard to "system effect" per AMCA Publication 201.
- 3.3 Leakage Tests: After each duct system is completed, test for duct leakage in accordance with Sections 3 and 5 of the SMACNA HVAC Air Duct Leakage Test Manual. Test pressure shall be equal to pressure class of duct, less 0.5" static pressure. Repair leaks and repeat tests until total leakage is less than 5% of system design air flow for low pressure systems and less than 1% for systems rated over 3".
- 3.4 Equipment Connections: Connect metal ductwork to equipment as indicated, provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.
- 3.5 Clean ductwork internally free of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration. Keep ducts closed with poly during construction to prevent contamination by construction dust and debris.
- 3.6 Balancing: Refer to Division-15 section "Testing, Adjusting, and Balancing" for air distribution balancing of metal ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.
- 3.7 System Adjustment: Adjust the system to provide functional operation to the extent possible, and leave ready for Testing and Balancing work. It is not the intent of this section to provide final testing and balancing, but to leave the system operational with a minimum of noise.

END OF SECTION

SECTION 15855/DUCTWORK ACCESSORIES1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-15 Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.3 Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this section.
- 1.4 Refer to other Division-15 sections for testing, adjusting, and balancing of ductwork accessories; not work of this section.
- 1.5 Codes and Standards:
 - 1.5.1 SMACNA Compliance: Comply with applicable portions of both SMACNA "HVAC Duct Construction Standards, Metal and Flexible".
 - 1.5.2 NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems" pertaining to installation of ductwork accessories.
- 1.6 Approval Submittals:
 - 1.6.1 Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions as follows:
 - 1.6.1.1 Flexible connections
 - 1.6.2 O&M Data Submittals: Submit manufacturer's maintenance data. Include this data, product data, and a copy of approval submittals in O&M manual.

2 PRODUCTS

- 2.1 Turning Vanes: Provide manufactured or fabricated single wall turning vanes and vane runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards".
- 2.2 Flexible Connections:
 - 2.2.1 General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.
 - 2.2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following: Duro Dyne Corp., Flexaust (The) Co., or Ventfabrics, Inc.

3 EXECUTION

- 3.1 Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
- 3.2 Installation of Ductwork Accessories:
- 3.2.1 Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- 3.2.2 Install turning vanes in square or rectangular 90° elbows in supply, return, and exhaust air systems, and elsewhere as indicated.
- 3.2.3 Install flexible connections in ductwork such that the clear length of the connector is approximately two inches. Provide thrust restraints as required. Flexible material shall not be so slack as to take a definite concave or convex shape during fan operation.
- 3.2.4 Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.
- 3.2.5 Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 15860/GRILLES, REGISTERS AND CEILING DIFFUSERS1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-15 Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.3 Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.
- 1.4 Refer to other Division-15 sections for ductwork and duct accessories required in conjunction with air outlets and inlets and for balancing of air outlets and inlets; not work of this section.
- 1.5 Codes and Standards:
 - 1.5.1 ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual". Provide air outlets and inlets bearing ADC Certified Rating Seal.
 - 1.5.2 NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".
- 1.6 Approval Submittals:
 - 1.6.1 Product Data: Submit manufacturer's technical product data for air outlets and inlets indicating construction, finish, and mounting details.
 - 1.6.2 Performance Data: For each type of air outlet and inlet furnished, provide aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections and data as required.
- 1.7 O&M Data Submittals: Submit cleaning instructions for finishes and spare parts lists. Include this data and a copy of approval submittals in O&M manual.

2 PRODUCTS2.1 General:

- 2.1.1 Except as otherwise indicated, provide manufacturer's standard grilles, registers, and ceiling diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- 2.1.2 Manufacturers not listed in the following specification will not be considered for approval unless accepted by addendum prior to bid.

- 2.1.3 Performance: Provide grilles, registers and ceiling diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device equal to the basis of design.
- 2.1.4 Ceiling and Wall Compatibility: Provide grilles, registers and diffusers with border styles that are compatible with adjacent wall and ceiling systems, and that are specifically manufactured to fit into ceiling module or wall with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems and walls which will contain each type of ceiling diffuser, grille, or register.
- 2.1.5 Appearance: All grilles and registers shall be aluminum construction and all diffusers shall be steel or aluminum construction, unless otherwise noted, with uniform matching appearance for each type of outlet. Ceiling mounted grilles and registers shall be set to be sight tight from the predominant exposure.
- 2.1.6 Finish: All ceiling mounted grilles, registers, and diffusers shall be finished with baked white enamel. Wall and door mounted grilles and registers shall be finished with clear anodized finish.
- 2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products by Titus, Metal Aire, Nailor or Price.
- 2.3 Exhaust Registers (ER-1): Provide exhaust registers with one set of 45 degree fixed louvers, parallel to the long dimension. Provide opposed blade damper, screwdriver operated from the face. Provide mounting frame for all wall and plaster ceiling installations. Titus 350 FL or Metalaire RHE.
- 2.4 Door Grilles (DG): Provide aluminum door grilles with vee core, fixed louvers, spaced ½", flanged frame, and telescoping auxiliary flanged frame. Provide prime coat ready for field painting. Titus CT-700 or Metalaire DGDF
- 3 EXECUTION
- 3.1 Coordinate installation with ceiling and light fixture installation. Locate ceiling outlets as indicated on architectural Reflected Ceiling Plans. Unless otherwise indicated, locate ceiling outlets in the center of acoustical ceiling modules with sides parallel to the grid.
- 3.2 Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.
- 3.3 Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.
- 3.4 Set air volumes to values shown on the drawings so that the system is functional. Leave ready for test and balance contractor.
- 3.5 Furnish to Owner three operating keys for each type of outlet and inlet that require them; obtain receipt.

END OF SECTION

SECTION 15970/START-UP REQUIREMENTS FOR HEATING, VENTILATING, & AIR CONDITIONING (HVAC) SYSTEMS1 GENERAL

1.1 Intent: It is the intent of this section to require that the startup requirements and report noted herein be performed prior to starting TAB work on each system. Work can be phased with permission of the Engineer.

1.2 Coordination:

1.2.1 The Contractor shall furnish to the TAB Contractor a complete set of plans, specifications, addenda, shop drawings, equipment performance data sheets, change orders, etc. as requested by the TAB Contractor.

1.2.2 The Contractor shall participate in a TAB coordination meeting to discuss interface requirements with the TAB Contractor and to establish a schedule for TAB work prior to start of TAB work.

1.3 Test Reports and Verification Submittals:

1.3.1 Submit Startup Report as described herein for each system. Attach Factory Startup Report for equipment as required by other Division-15 sections.

2 PRODUCTS: None3 EXECUTION:

3.1 The TAB work shall not commence until the Engineer has received written notice from the Contractor that HVAC systems are 100% complete and are fully operational. Submit Startup Report as described herein.

3.2 The Contractor shall place all HVAC systems and equipment into complete operation during each working day of TAB work.

3.3 The Contractor shall provide access to HVAC systems and equipment by supplying ladders and/or scaffolding, and opening access panels and equipment room doors.

3.4 The TAB Contractor will provide to the Contractor TAB punch lists of non-complying HVAC work as they are discovered. The Contractor shall replace or repair non-complying work as soon as possible in order not to delay completion of TAB work.

3.5 Airside Systems: The Contractor shall provide the following information to the Engineer to substantiate proper start-up and preliminary adjustments of air handler units, belt driven fans, and duct systems.

3.5.1 Verify that air grilles (supply, return, exhaust, transfer, outdoor, etc.) are installed and connected to the duct system.

- 3.5.2 Verify that duct systems are clean of debris.
- 3.5.3 Verify that ducts attached with flexible connectors are aligned within ½" and have a uniform gap between ducts of 1"-1.5". Flexible connectors shall not leak and shall be insulated.
- 3.5.4 Verify that fan discharges are appropriate for the outlet ductwork with regards to the "system effect" per AMCA Publication 201. Inappropriate fan discharges will not be accepted.
- 3.5.5 Verify proper fan rotation.
- 3.5.6 Verify fan motor overload elements are correctly sized.
- 3.5.7 Verify that HVAC control systems are fully operational.
- 3.6 Startup Report: The Contractor shall submit the startup information required by this section to the Engineer in a typed report organized as outlined herein. The Startup Report is required to meet the written notice described herein prior to starting TAB work. TAB work will not start until the Startup Report has been submitted and approved.

END OF SECTION

SECTION 15985/TESTING AND BALANCING OF MECHANICAL SYSTEMS1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section. Division-15 Basic Mechanical Materials Sections apply to work of this section.

1.2 Description of Work:

- 1.2.1 Extent of testing, adjusting, and balancing work (TAB) is indicated by requirements of this section, and also by drawings and schedules, and is defined to include, but is not necessarily limited to, air distribution systems, hydronic distribution systems and associated equipment and apparatus of mechanical work. The work consists of setting speed and volume (flow) adjusting facilities provided for systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required.

- 1.2.2 Coordination Meeting: A pre-TAB meeting shall be held to coordinate with the Engineer, General Contractor, Mechanical Contractor and Controls Contractor responsible for the HVAC system installation as required to complete the TAB work. TAB requirements for reporting, testing and optimization shall be reviewed at this meeting.

- 1.3 The intent of this specification is to balance HVAC systems within the tolerances listed, maintaining the pressure relationships indicated, with a minimum of noise and energy use. This process is inherently iterative in nature.

1.3.1 Airflow Tolerances:

- 1.3.1.1 Exhaust Fans: The exhaust fan quantities shall be set as required to maintain the design exhaust terminal flows within $\pm 5\%$ of design values. If no exhaust terminals exist, exhaust fan air quantities shall be balanced within $\pm 10\%$ of design values.

1.4 Quality Assurance: The TAB Contractor shall be certified as follows:

- 1.4.1 Tester: A firm certified by National Environmental Balancing Bureau (NEBB) in those testing and balancing disciplines required for this project, who is not the Installer of the systems to be tested and is otherwise independent of the project. Comply with NEBB's "Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems" as applicable to this work.

- 1.4.2 Tester: A firm certified by Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project. AABC-certified firms are independent by definition. Comply with AABC's Manual MN-1 "AABC National Standards", as applicable to this work.

- 1.4.3 Industry Standards: Comply with American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) recommendations pertaining to measurements, instruments and testing, adjusting and balancing, except as otherwise indicated.

1.5 Job Conditions:

1.5.1 Do not proceed until coordination meeting has been held.

1.5.2 Do not proceed with testing, adjusting, and balancing work until HVAC work (including Controls) has been completed and is operable. Ensure that there is no residual work still to be completed.

1.5.3 Do not proceed until work scheduled for testing, adjusting, and balancing is clean and free from debris, dirt and discarded building materials.

1.5.4 Do not proceed until duct pressure tests are complete and satisfactory.

1.5.5 Do not proceed until architectural work that would affect balancing (walls, ceiling, windows, doors) have been installed.

1.5.6 Testing may proceed system by system, but each HVAC system must be complete as describe herein.

1.5.7 The mechanical contractor shall make any changes in pulleys, belts, and dampers, and/or add dampers as required for correct balancing.

1.6 Approval Submittals

1.6.1 Submit the name of the proposed test and balance company for the Engineer's approval within thirty (30) days after awarding of contract.

1.7 Test Reports and Verification Submittals:

1.7.1 Submit four (4) copies of the dated test and balance report upon completion of TAB work. The report shall include a list of instruments used for the work. The report shall be signed by the supervisor who performed the TAB work.

2 PRODUCTS

2.1 Patching Materials: Except as otherwise indicated, use same products as used by original Installer for patching holes in insulation, ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.

2.2 Test Instruments: Utilize test instruments and equipment of the type, precision, and capacity as recommended in the referenced standard. All instruments shall be in good condition and shall have been calibrated within the previous six (6) months (or more recently if required by standard).

3 EXECUTION

3.1 General:

- 3.1.1 Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned and is operable. Do not proceed with TAB work until unsatisfactory conditions have been corrected in manner acceptable to Tester.
- 3.1.2 Test, adjust and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable standards, and as modified or detailed herein.
- 3.1.3 Test, adjust and balance systems during summer season for air conditioning systems and during winter season for heating systems, including at least a period of operation at outside conditions within 5°F wet bulb temperature of maximum summer design condition, and within 10°F dry bulb temperature of minimum winter design condition. When seasonal operation does not permit measuring final temperatures, then take final temperature readings when seasonal operation does permit. The Contractor shall return for a change of seasons test at no additional cost to the Owner and submit the revised TAB report.
- 3.1.4 Punch List: Prepare a deficiency (punch)list for the Contractor with a copy to the Engineer that lists all items that are incorrectly installed or are functioning improperly. Provide a retest after all items are corrected.
- 3.1.5 Prepare TAB report of test results, including instrumentation calibration reports, in format recommended by applicable standards, modified as required to include all data listed herein.
- 3.1.6 Patch holes in insulation, ductwork and housings which have been cut or drilled for test purposes in manner recommended by original Installer.
- 3.1.7 Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings at completion of TAB work. Provide markings with paint or other suitable permanent identification materials.
- 3.1.8 Include in the TAB report recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.
- 3.1.9 Include an extended warranty of ninety (90) days after completion of test and balance work, during which time the Engineer, at his discretion, may request a recheck, or resetting of any component as listed in test report. The TAB company shall provide technicians and instruments and make any tests required by the Engineer during this time period.
- 3.2 Controls
- 3.2.1 Check all HVAC controls for proper location, calibration and sequence of operation.
- 3.3 Air Balancing
- 3.3.1 Leakage tests on ductwork must have been completed before air balancing.
- 3.3.2 Set dampers, volume controls and fan speeds to obtain specified air delivery with minimum noise level and minimum energy use. Rebalance as required to accomplish this. Simulate fully loaded filters during test.

- 3.3.3 Record all fan speeds.
- 3.3.4 Airflow Measurement: Airflow measurements for exhaust fans (EF) shall be obtained by duct traverse and reported in the TAB Report. The location of the traverse shall be indicated on a sketch included in the TAB Report. If airflow is determined by any other means than a traverse (i.e., sum of outlets, or other indirect method) it shall be clearly stated in the TAB Report. Organize TAB Report contemporaneous data so that the following can be readily checked:
 - 3.3.4.1 Comparison of actual cfm to design cfm and percent variance.
 - 3.3.4.2 Comparison of each EF cfm to the sum of the inlets for the EF.
- 3.3.5 Static Pressure Measurement: Static pressure (SP) measurements for EFs shall be obtained at both suction and discharge so that total static pressure (TSP) can be reported. Plot design cfm and SP on fan curve and include in TAB Report. Organize TAB Report contemporaneous data so that the following can be readily checked:
 - 3.3.5.1 Comparison of actual SP to design SP for each fan.
- 3.4 Data Collection:
 - 3.4.1 In addition to the data required for any specified performance tests, measure and record the temperatures, pressures, flow rates, and nameplate data for all components listed herein.
 - 3.4.2 It is the intent of this section to record data on balanced systems, under normal operating or design conditions. Data collection and recording shall be precise and contemporaneous so that flows and temperatures can be used to calculate coil Btu/hr for both airside and waterside. Acceptable Btu/hr calculation variation is 10%.
 - 3.4.3 Pressures:
 - 1. Suction and discharge static pressure of each fan.
 - 3.4.4 Flow rates:
 - 1. Flow rate through each fan.
 - 2. Flow rate through each air distribution device.
 - 3.4.5 Nameplate Data:
 - 1. Complete nameplate data for all equipment.
 - 2. Motor data to include horsepower, phase, voltage, RPM, full load nameplate current, fuse rating in disconnect switch, number or manufacturer's size designation, and ampere rating of overcurrent and low voltage protection devices in starters.

END OF SECTION

SECTION 16005/ELECTRICAL GENERAL1 GENERAL

- 1.1 The work covered by this division consists of providing all labor, equipment and materials and performing all operations necessary for the installation of the electrical work as herein called for and shown on the Drawings.
- 1.2 Related Documents:
- 1.2.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- 1.2.2 This is a Basic Electrical Requirements Section. Provisions of this Section apply to work of all Division 16 Sections.
- 1.2.3 Review all project Drawings to be aware of conditions affecting work herein.
- 1.2.4 Definitions:
- 1.2.4.1 Provide: Furnish, install, and test, complete and ready for intended use.
- 1.2.4.2 Furnish: Supply and deliver to project site, ready for subsequent requirements.
- 1.2.4.3 Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, test complete ready for intended use, and similar requirements.
- 1.3 Permits and Fees: Contractor shall obtain all necessary permits, meters, and inspections required for his work and pay all fees and charges incidental thereto.
- 1.4 Verification of Owner's Data: Prior to commencing work the Contractor shall satisfy himself as to the accuracy of all data indicated on the Drawings and/or provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, he shall immediately notify the Engineer. Commencement of work by the Contractor shall be held as an acceptance of the data by him after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions or inaccuracies of the said data.
- 1.5 Delivery and Storage of Materials: Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. All material shall be stored to provide protection from the weather and damage.
- 1.6 Extent of work is indicated in the Drawings, Schedules, and Specification. Singular references shall not be construed as requiring only one device if multiple devices are shown on the Drawings or are required for proper system operation.

1.7 Field Measurements and Coordination:

- 1.7.1 The intent of the Drawings and Specifications is to obtain a complete and satisfactory installation. Separate divisional Drawings and Specifications shall not relieve the Contractor from full compliance of work indicated on any of the Drawings or in any Section of the Specifications. Report conflicts prior to start of work.
- 1.7.2 Verify all field dimensions and locations of equipment to insure close, neat fit with other trades' work. Make use of all Contract Documents and approved shop drawings to verify exact dimension and locations. Do not scale electrical drawings, rely on dimensions shown on architectural or structural drawings.
- 1.7.3 Coordinate work in this Division in proper sequence to insure that the total work is completed within Contract time schedule and with minimum cutting and patching.
- 1.7.4 Locate all equipment, materials, and apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on electrical drawings, be guided by architectural details and conditions existing at job and correlate this work with that of others.
- 1.7.5 Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings and passageways. Cut no structural members without written approval from Engineer or Architect.
- 1.7.6 Carefully examine any existing conditions, piping, and premises. Compare Drawings with existing conditions. Report any observed discrepancies. Written instructions will be issued by the Engineer to resolve discrepancies.
- 1.7.7 Because of the small scale of the Drawings, it is not possible to indicate all offsets and fittings or to locate every accessory. Drawings are essentially diagrammatic. Study carefully the sizes and locations of structural members, wall and partition locations, trusses, and room dimensions and take actual measurements on the job. Locate material, equipment and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the Drawings. If field measurements show that equipment or material will not fit, the Engineer shall be consulted. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.

1.8 Guarantee and Service:

- 1.8.1 Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond nor relieving Contractor of his responsibilities during guarantee period.
- 1.8.2 The Contractor shall guarantee labor, materials and equipment for a period of one (1) year from Substantial Completion, or from Owner's occupancy, whichever is earlier. Contractor shall make good any defects and shall include all necessary adjustments to and replacement of defective items without expense to the Owner.

1.9 Approval Submittals:

- 1.9.1 When approved, the submittal control log and submittals shall be an addition to the specifications herewith, and shall be of equal force in that no deviation will be permitted except with the approval of the Architect/Engineer.
- 1.9.1.1 Shop drawings, product literature, and other approval submittals will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions and Division 1 Specification sections and the following.
- 1.9.1.1.1 Submittals shall be properly organized in accordance with the approved submittal control log.
- 1.9.1.1.2 Submittals shall not include items from more than one specification section in the same submittal package unless approved in the submittal control log.
- 1.9.1.1.3 Submittals shall be properly identified by a cover sheet showing the project name, Architect and Engineer names, submittal control number, specification section, a list of products or item names with model numbers in the order they appear in the package, and spaces for approval stamps. A sample cover sheet is included at the end of this section.
- 1.9.1.1.4 Submittals shall have been reviewed and approved by the General Contractor (or Prime Contractor). Evidence of this review and approval shall be an "Approved" stamp with a signature and date on the cover sheet.
- 1.9.1.1.5 Submittals that include a series of fixtures or devices (such as lighting fixtures) shall be organized by the fixture number and be marked accordingly. Each fixture must include all items associated with that fixture regardless of whether or not those items are used on other fixtures.
- 1.9.1.1.6 The electrical design shown on the drawings supports the mechanical equipment basis of design specifications at the time of design. If mechanical equipment is submitted with different electrical requirements, it is the responsibility of the mechanical contractor to resolve all required electrical design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electrical design on the mechanical submittal with a written statement that this change will be provided at no additional cost. Mechanical submittals made with no written reference to the electrical design will be presumed to work with the electrical design. Any corrections required will be at no additional cost.
- 1.9.2 If the shop drawings show variation from the requirements of contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variation in writing in his letter of transmittal and on the submittal cover sheet in order that, if acceptable, Contractor will not be relieved of the responsibility for executing the work in accordance with the contract.
- 1.9.3 Review of shop drawings, product literature, catalog data, or schedules shall not relieve the Contractor from responsibility for deviations from contract drawings or specifications, unless he has in writing called to the attention of the Architect/Engineer each such deviation in writing at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings, product literature, catalog data, or schedules. Any feature or function specified but not mentioned in the submittal shall be assumed to be included per the specification.

- 1.9.4 Submit shop drawings as called for in other sections after award of the contract and before any material is ordered or fabricated. Shop drawings shall consist of plans, sections, elevations and details to scale (not smaller than 1/4" per foot), with dimensions clearly showing the installation. Direct copies of small scale project drawings issued to the Contractor are not acceptable. Drawings shall take into account equipment furnished under other sections and shall show space allotted for it. Include construction details and materials.
- 1.10 Test Reports and Verification Submittals: Submit test reports, certifications and verification letters as called for in other sections. Contractor shall coordinate the required testing and documentation of system performance such that sufficient time exists to prepare the reports, submit the reports, review the reports and take corrective action within the scheduled contract time.
- 1.11 O&M Data Submittals: Submit Operation and Maintenance data as called for in other sections. When a copy of approval submittals is included in the O&M Manual, only the final "Approved" or "Approved as Noted" copy shall be used. Contractor shall organize these data in the O&M Manuals tabbed by specification number. Prepare O&M Manuals as required by Division 1 and as described herein. Submit O&M Manuals on CD-ROM in addition to required hard bound copies.
- 2 PRODUCTS
- 2.1 All materials shall be new or Owner-supplied reused as shown on the drawings, the best of their respective kinds, suitable for the conditions and duties imposed on them at the building and shall be of reputable manufacturers. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the following sections.
- 2.2 Equipment and Materials:
- 2.2.1 Shall be new and the most suitable grade for the purpose intended. Equipment furnished under this division shall be the product of a manufacturer regularly engaged in the manufacture of such items for a period of three years. Where practical, all of the components shall be products of a single manufacturer in order to provide proper coordination and responsibility. Where required, Contractor shall furnish proof of installation of similar units or equipment.
- 2.2.2 Each item of equipment shall bear a name plate showing the manufacturer's name, trade name, model number, serial number, ratings and other information necessary to fully identify it. This plate shall be permanently mounted in a prominent location and shall not be concealed, insulated or painted.
- 2.2.3 The label of the approving agency, such as UL or NEMA, by which a standard has been established for the particular item shall be in full view. Materials shall be UL-listed for the application specified or indicated on the Drawings or Specifications.
- 2.2.4 The equipment shall be essentially the standard product of a manufacturer regularly engaged in the production of such equipment and shall be a product of the manufacturer's latest design.
- 2.2.5 A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.

- 2.2.6 Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.
- 2.2.7 Materials and equipment are specified herein by a single or by multiple manufacturers to indicate quality, material and type of construction desired. Manufacturer's products shown on the Drawings have been used as basis for design; it shall be the Contractor's responsibility to ascertain that alternate manufacturer's products meet detailed specifications and that size and arrangement of equipment are suitable for installation.
- 2.2.8 Model Numbers: Catalog numbers and model numbers indicated in the Drawings and Specifications are used as a guide in the selection of the equipment and are only listed for the Contractor's convenience. The Contractor shall determine the actual model numbers for ordering equipment and materials in accordance with the written description of each item and with the intent of the Drawings and Specifications.
- 2.3 Requests for Substitution:
- 2.3.1 Where a particular system, product or material is specified by name, consider it as standard basis for bidding, and base proposal on the particular system, product or material specified.
- 2.3.2 Requests by Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.
- 2.3.3 Required product cannot be supplied in time for compliance with Contract time requirements.
- 2.3.4 Required product is not acceptable to governing authority, or determined to be non-compatible, or cannot be properly coordinated, warranted or insured, or has other recognized disability as certified by Contractor.
- 2.3.5 Substantial cost advantage is offered Owner after deducting offsetting disadvantages including delays, additional compensation for redesign, investigation, evaluation and other necessary services and similar considerations.
- 2.3.6 All requests for substitution shall contain a "Comparison Schedule" and clearly and specifically indicate any and all differences or omissions between the product specified as the basis of design and the product proposed for substitution. Differences shall include but shall not be limited to data as follows for both the specified and substituted products:
- 2.3.6.1 Principal of operation.
- 2.3.6.2 Materials of construction or finishes.
- 2.3.6.3 Thickness of gauge of materials.
- 2.3.6.4 Weight of item.
- 2.3.6.5 Deleted features or items.
- 2.3.6.6 Added features or items.

2.3.6.7 Changes in other work caused by the substitution.

2.3.6.8 Performance curves.

2.3.7 If the approved substitution contains differences or omissions not specifically called to the attention of the Architect/Engineer, the Owner reserves the right to require equal or similar features to be added to the substituted products (or to have the substituted products replaced) at the Contractor's expense.

2.4 Prior Approval

2.4.1 Prior Approval shall be required for any manufacturer other than those listed for all specified items in the Drawings and Specifications. Submit all requests for approval of the alternate products to meet the time requirements of the Invitation to Bid. Approval will be in the form of an Addendum to the Specifications and Drawings. Clearly indicate all differences between the specified and proposed product following the guidelines for "Request for Substitution" herein. This requirement may be waived if, in the opinion of the engineer, it is in the best interest of the Owner. Submittals received after the award of the bid for equipment that has not been Prior Approved is subject to immediate rejection.

3 EXECUTION

3.1 Workmanship: All materials and equipment shall be installed and completed in a first-class workmanlike manner and in accordance with the best modern methods and practice. Any materials installed which do not present an orderly and reasonably neat and/or workmanlike appearance, or do not allow adequate space for maintenance, shall be removed and replaced when so directed by the Architect/Engineer.

3.2 Coordination:

3.2.1 The Contractor shall be responsible for full coordination of the electrical systems with shop drawings of the building construction so the proper openings and sleeves or supports etc., are provided for conduit, devices, or other equipment passing through slabs or walls.

3.2.2 Any additional steel supports required for the installation of any electrical equipment, fixtures or conduit shall be provided by the Contractor.

3.2.3 It shall be the Contractor's responsibility to see that all equipment that may require maintenance and operation are made easily accessible, regardless of the diagrammatic location shown on the Drawings.

3.2.4 All connections to fixtures and equipment shown on the Drawings shall be considered diagrammatic unless otherwise indicated by a specific detail on the Drawings. The actual connections shall be made to fully suit the requirements of each case and adequately provide for servicing.

3.2.5 The Contractor shall protect equipment and fixtures at all times during storage and construction. He shall replace all equipment and fixtures which are damaged as a result of inadequate protection.

- 3.2.6 Prior to starting and during progress of work, examine work and materials installed by others as they apply to work in this division. Report conditions which will prevent satisfactory installation.
- 3.2.7 Start of work will be construed as acceptance of suitability of work of others.
- 3.3 Construction Electrical Utilities: Provide all temporary wiring for power and light required for construction purposes and remove such temporary wiring when use is no longer required.
- 3.4 Service Coordination: Prior to commencing any work, coordinate with utility/service provider to ensure proper services are available to project when needed.
- 3.5 Interruption of Service: Before any equipment is shut down for disconnecting or tie-ins, arrangements shall be made with the Architect/Engineer and this work shall be done at the time best suited to the Owner. This will typically be on weekends and/or holidays and/or after normal working hours. Services shall be restored the same day unless prior arrangements are made. All overtime or premium costs associated with this work shall be included in the base bid.
- 3.6 Cutting and Patching: Contractor shall provide all cutting and patching of all holes, chases, sleeves, and other openings required for installation of equipment furnished and installed under this section. Utilize experienced trades for cutting and patching. Obtain permission from Architect/Engineer before cutting any structural items.
- 3.7 Equipment Setting: Bolt equipment directly to concrete pads or foundations, using hot-dipped galvanized anchor bolts, nuts and washers. Level equipment.
- 3.8 Painting: Touch-up factory finishes on equipment located inside and outside shall be done under Division 16. Obtain matched color coatings from the manufacturer and apply as directed by manufacturer. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required.
- 3.9 Clean-up: Thoroughly clean all exposed parts of apparatus and equipment of cement, plaster, and other materials and remove all oil and grease spots. Repaint or touch up as required to look like new. During progress of work, Contractor is to carefully clean and leave premises free from debris and in a safe condition.
- 3.10 Start-up and Operational Test: Start each item of equipment in strict accordance with the manufacturer's instructions; or where noted under equipment specification, start-up shall be done by a qualified representative of the manufacturer. Alignment, lubrication, safety, and operating control shall be included in start-up check.
- 3.11 Record (As Built) Drawings:
- 3.11.1 During the progress of the work the Contractor shall record on their field set of Drawings the corrections, variations, and deviations for systems which are not installed exactly as shown on the Contract Drawings.
- 3.11.2 Upon completion of the work, record drawings shall be prepared as described in the General Conditions, Supplementary Conditions, and Division 1 Sections.

- 3.12 Acceptance:
- 3.12.1 Punch List: Submit written confirmation that all punch lists have been checked and the required work completed.
- 3.12.2 Instructions: At completion of the work, provide a competent and experienced person who is thoroughly familiar with the project, for a period deemed necessary by the Owner to instruct permanent operating personnel in the operation of equipment and control systems.
- 3.12.3 Operation and Maintenance Manuals: Furnish four complete manuals bound in ring binders with Table of Contents, organized, and tabbed by specification section. Manuals shall contain:
- 3.12.3.1 Detailed operating instructions and instructions for making minor adjustments.
- 3.12.3.2 Complete wiring and control diagrams.
- 3.12.3.3 Routine maintenance operations.
- 3.12.3.4 Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.
- 3.12.3.5 Copies of approved submittals.
- 3.12.3.6 Copies of all manufacturer's warranties.
- 3.12.3.7 Copies of test reports and verification submittals.
- 3.12.4 Test together and separately to determine that:
- 3.12.4.1 System is free from short circuits and other faults.
- 3.12.4.2 Motor starter overload devices are sized correctly.
- 3.12.4.3 Motors rotate correctly.
- 3.12.4.4 All equipment operates correctly and as specified.
- 3.12.5 Record Drawings: Submit "Record Drawings".
- 3.12.6 Install engraved metal or plastic nameplates or tags on controls, panels, switches, starters, timers, and similar operable equipment, keyed by number to operating instructions. Dymo type labels are not acceptable.
- 3.12.7 Acceptance will be on the basis of tests and inspections of the work. A representative of the firm which performed the testing shall be in attendance to assist during inspection. Contractor shall furnish necessary electricians to operate system, make any necessary adjustments and assist with final inspection.
- 3.12.8 Control Diagrams: Frame under glass and mount on equipment room wall.

**This is a sample cover sheet.
Use one for each shop drawing.**

PROJECT NAME
PROJECT NUMBER

SAMPLE

ARCHITECT/ENGINEER: Moses & Associates, Inc.

CONTRACTOR: XYZ Construction

SUBCONTRACTOR: ABC Electrical Contractor

SUPPLIER: Jones Supply Co.

MANUFACTURER: Various

DATE: 2/12/07

SECTION: 16520 / Interior Lighting

1. Type A

List each item separately

2. Type B

**Typical - list mfr name
& model number**

3. Type C

4. Type D

5. Type E

**General Contractor's
APPROVAL stamp must
be on this sheet.**

END OF SECTION

SECTION 16020/CODES AND STANDARDS1 GENERAL

- 1.1 All work under Division 16 shall be constructed in accordance with the codes and standards listed herein. The design has been based on the requirements of these codes and standards. While it is not the responsibility of the Contractor to verify that all work called for complies with these codes and standards, he shall be responsible for calling to the Engineer's attention any details on the Drawings and/or Specifications that are not in conformance with these or other codes and standards. Current issue of code applies unless specifically noted otherwise.
- 1.2 Comply with regulations and codes of suppliers of utilities.
- 1.3 Where no specific method or form of construction is called for in the Contract Documents, the Contractor shall comply with code requirements when carrying out such work.
- 1.4 Where code conflict exists, generally the most stringent requirement applies.
- 1.5 Codes or standards applying to a specific part of the work may be included in that section.

2 CODES

- 2.1 Florida Building Code - Building - 2007 with 2009 amendments
- 2.2 National Electrical Code (NFPA 70) - 2008
- 2.3 National Fire Alarm Code (NFPA 72) - 2002
- 2.4 Uniform Fire Code (NFPA 1) - 2006 Florida Edition
- 2.5 National Electrical Safety Code (NESC)
- 2.6 Life Safety Code (NFPA 101) - 2006 Florida Edition

3 STANDARDS

- 3.1 All electrical materials, installation and systems shall meet the requirements of the following standards, including the latest addenda and amendments:
 - 3.1.1 American National Standard Institutes (ANSI)
 - 3.1.2 Illuminating Engineering Society (IES).
 - 3.1.3 Institute of Electrical and Electronics Engineers (IEEE).
 - 3.1.4 National Electrical Manufacturer's Associations (NEMA).
 - 3.1.5 National Fire Protection Association (NFPA).

- 3.1.6 Occupational Safety and Health Act (OSHA).
- 3.1.7 Underwriter's Laboratories, Inc. (UL).

END OF SECTION

SECTION 16030/ELECTRICAL RELATED WORK1 DIVISION 1 - GENERAL REQUIREMENTS

- 1.1 All Division 1 Sections apply to all Division 16 Sections.
- 1.2 Coordinate for all cutting and patching. Contractor shall review all cutting and patching required prior to bidding and shall coordinate installation.

2 DIVISION 2 - SITEWORK

- 2.1 Specific requirements for excavation and backfill for underground conduit are contained in Section 16105.
- 2.2 The following is part of Division 16 work.
 - 2.2.1 Underground electrical utilities.

3 DIVISION 3 - CONCRETE

- 3.1 Perform the following as part of Division 16 work, complying with the requirements of Division 3, Concrete.
 - 3.1.1 Curbs, foundations and pads for electrical equipment.
 - 3.1.2 Encasement of electrical work.
 - 3.1.3 Underground structural concrete to accommodate electrical work.
 - 3.1.4 Rough grouting in and around electrical work.
 - 3.1.5 Patching concrete cut to accommodate electrical work.

4 DIVISION 4 - MASONRY

- 4.1 Refer to Division 4, Masonry for:
 - 4.1.1 Patching openings to accommodate electrical work.

5 DIVISION 5 - METALS

- 5.1 Refer to Division 5, Metals for:
 - 5.1.1 Supports for electrical work.
 - 5.1.2 Framing openings for electrical equipment.

6 DIVISION 6 - WOOD

6.1 Refer to Division 6, Wood for:

6.1.1 Supports for electrical work.

6.1.2 Framing openings for electrical equipment.

7 DIVISION 7 - THERMAL & MOISTURE PROTECTION

7.1 Refer to Division 7, Thermal and Moisture Protection for:

7.1.1 Installation of all supports for electrical work.

7.1.2 Caulking and waterproofing of all wall and roof mounted electrical work.

7.2 Perform the following as part of Division 16 work, complying with Division 7 requirements.

7.2.1 Fire barrier penetration seals.

7.2.2 Caulking and related shielding around ducts and pipes for sound isolation and attenuation.

8 DIVISION 8 - DOORS AND WINDOWS

8.1 Refer to Division 8, Doors & Windows for:

8.1.1 Installation of all access doors for electrical work.

9 DIVISION 9 - FINISHES

9.1 Refer to Division 9, Finishes for:

9.1.1 Painting exposed conduit and equipment.

9.1.2 Painting structural metal and concrete for electrical work.

9.1.3 Painting access panels.

9.2 Colors shall be selected by the Architect for all painting of exposed electrical work unless specified herein.

9.3 Perform the following as part of Division 16 work.

9.3.1 Touch up painting of factory finishes.

10 DIVISION 15 - MECHANICAL

10.1 Mechanical Contractor shall furnish to Electrical Contractor all necessary nameplate data, equipment power requirements, wiring diagrams, etc., pertaining to the electrical phase of

- mechanical installation, as well as all required motors, on/off switches, warning lights, relays, and control devices.
- 10.2 Contractor shall furnish and install all power wiring, starters and contactors, and make final electrical connections to motors, on/off switches, warning lights, relays, and control devices.
- 10.3 Disconnect switches for mechanical equipment shall be furnished and installed by the Contractor, unless specifically noted on the Drawings as being furnished as part of mechanical equipment.
- 10.4 Wiring for controls as indicated on the electrical drawings shall be furnished and installed by the electrical contractor. Control wiring and signal wiring between field installed controls, indicating devices and unit control panels as part of mechanical energy management system shall be provided by Division 15, complying with the requirements of Division 16 specifications.

END OF SECTION

SECTION 16100/BASIC MATERIALS AND METHODS1 GENERAL1.1 Related Documents

1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.1.2 This Section is a Division-16 Basic Materials and Methods Section, and is part of each Division-16 Section making reference to or requiring products specified herein.

1.1.3 The requirements of these specifications also apply to Divisions 15, 17 and 18, unless clearly indicated within those Divisions.

1.2 Summary

1.2.1 This Section includes the following:

1.2.1.1 Raceways.

1.2.1.2 Building wire and connectors.

1.2.1.3 Supporting devices for electrical components.

1.2.1.4 Concrete equipment bases.

1.2.1.5 Cutting and patching for electrical construction.

1.2.1.6 Touchup painting.

1.3 Definitions

1.3.1 EMT: Electrical metallic tubing.

1.3.2 FMC: Flexible metal conduit.

1.3.3 RGS: Rigid galvanized steel conduit.

1.3.4 LFMC: Liquidtight flexible metal conduit.

1.3.5 RNC: Rigid nonmetallic conduit.

1.4 Quality Assurance

1.4.1 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4.2 Comply with NFPA 70.

1.4.3 All materials and equipment specified herein shall be UL listed or approved according to the requirements of applicable NEC articles.

1.5 Coordination

1.5.1 Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1.5.2 Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

1.5.3 Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

1.5.4 Coordinate electrical service connections to components furnished by utility companies.

1.5.5 Coordinate installation and connection of exterior underground utilities and services, including provision for electricity-metering components.

1.5.6 Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

1.5.7 Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."

1.6 Approval Submittals:

1.6.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each product provided.

2 PRODUCTS

2.1 Manufacturers

2.1.1 Manufacturers: Subject to compliance with requirements, provide products by the following:

2.1.1.1 Allied Tube and Conduit;

2.1.1.2 Appleton Electric;

2.1.1.3 Belden Corporation;

2.1.1.4 Bridreport;

2.1.1.5 Ideal;

2.1.1.6 Erico;

- 2.1.1.7 W.H. Brady Co.;
- 2.1.1.8 Carlon;
- 2.1.1.9 Challenger, Crouse-Hinds Co.;
- 2.1.1.10 ETP;
- 2.1.1.11 Elcen Metal Products Co.;
- 2.1.1.12 General Cable Co.;
- 2.1.1.13 General Electric Co.;
- 2.1.1.14 Hoffman Engineering Co.;
- 2.1.1.15 Harvey Hubbell, Inc.;
- 2.1.1.16 Midland-Ross Corporation;
- 2.1.1.17 Okonite Co.;
- 2.1.1.18 0-Z/Gedney;
- 2.1.1.19 Quazite;
- 2.1.1.20 Racor, Inc.;
- 2.1.1.21 CDR;
- 2.1.1.22 Republic Steel Corporation;
- 2.1.1.23 3M;
- 2.1.1.24 Southwire;
- 2.1.1.25 Seton Nameplate;
- 2.1.1.26 Square D Co.;
- 2.1.1.27 Thomas and Betts;
- 2.1.1.28 Triangle PWC, Inc.;
- 2.1.1.29 Walker Parkersburg Textron;
- 2.1.1.30 Wiremold Co.,
- 2.1.1.31 Westinghouse Engine Div.

2.1.1.32 Wheatland

2.2 Raceways

2.2.1 EMT: ANSI C80.3, galvanized steel, protected inside and out. Maximum size of EMT shall be 4". Minimum size shall be ½" unless noted otherwise on the Drawings. EMT shall only be used with cables rated 600 volts or less and in indoor locations not subject to physical abuse.

2.2.2 FMC: galvanized steel protected inside and out.

2.2.3 RGS: galvanized steel, protected inside and out.

2.2.4 LFMC: galvanized steel protected inside and out with sunlight-resistant and mineral-oil-resistant plastic jacket.

2.2.5 RNC: NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.

2.2.6 Raceway Fittings

2.2.6.1 Specifically designed for the raceway type with which used.

2.2.6.2 RGS shall have threaded fittings, galvanized steel or threadless compression galvanized steel or threadless compression cadmium plated malleable iron. Fittings shall be rain tight/concrete tight.

2.2.6.3 RNC shall have polyvinyl chloride (PVC) fittings suited for the purpose and joined together by a method approved for the purpose. Schedule 80 conduit sections may be joined together with threaded fitting connectors.

2.2.6.4 EMT: Federal Specification W-F-408, except only material of steel or malleable iron is acceptable. Couplings and connectors shall be concrete and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 2" and smaller. Use set screw type couplings with four set screws each for conduit sizes over 2". Use set screws of casehardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding. Indent type connectors or couplings are prohibited. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.

2.2.6.5 FMC fittings shall be zinc plated steel or cadmium plated malleable iron screw type with insulated throat and angular wedge fitting between convolutions of conduit. Federal Specification W-F-406 and UL 5.

2.2.6.6 LFMC fittings shall be cadmium plated, malleable iron or steel with compression type steel ferrule and neoprene gasket sealing rings, with insulated throat.

2.2.6.7 Wireway fittings shall be steel with rust resistant undercoat and finish coat to match the wireway. The fittings shall be so designed that the sections can be electrically and mechanically fitted together to form a complete system. Dead ends shall be closed.

2.2.6.8 Couplings and Unions shall be galvanized steel, tapered thread standard conduit couplings for intermediate metal conduit and RGS. PVC couplings for rigid non-metallic conduit shall use

approved adhesive, and threaded couplings shall be used for schedule 80 conduit. Split couplings shall be galvanized steel. Unions shall be ground joint type galvanized steel.

2.2.7 Bushings

2.2.7.1 Shall be provided at the end of all conduits prior to pulling cables to protect the insulation of the conductor. Provide grounding bushings for metal raceways, boxes, and cabinets to insure that all metallic surfaces are effectively grounded. Metallic raceway may be bonded to cabinets, boxes and panelboards by double locknut and bushing to ensure the metallic parts are all effectively grounded. Bushings shall be one of the following types:

2.2.7.2 Zinc plated steel, threaded or threadless

2.2.7.3 Zinc plated steel of threaded or threadless, phenolic insulated with temperature rating of 105 degree C

2.2.7.4 Cadmium plated malleable iron, threaded or threadless

2.2.7.5 Cadmium plated malleable iron, threaded or threadless, phenolic insulated, with temperature rating of 105 degree C

2.2.7.6 Phenolic with temperature rating of 105 degree C

2.2.7.7 Zinc plated steel, or cadmium plated malleable iron; threaded or threadless; non-insulated or insulated with grounding connector or grounding lug

2.3 Metal Wireways

2.3.1 Material and Construction: Shall be sheet metal troughs with hinged or removable covers, rust resistant undercoat and gray finish coat. Sizes shall be as indicated on the Drawings or determined by the Contractor based on NEC requirements according to the number of conductors enclosed. Exterior units shall be weatherproof. Steel shall be minimum 14 gauge.

2.3.2 Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.3.3 Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

2.4 Surface Raceways

2.4.1 Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard coating.

2.4.1.1 Manufacturers: Walker Systems, Inc.; Wiremold Company (The).

2.4.2 Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.5 Boxes, Enclosures, and Cabinets

- 2.5.1 Sheet Metal Outlet and Device Boxes: Galvanized, NEMA OS 1. Boxes shall be 4"x 4" x 1-1/2" deep or larger (4" wide x 4" long x 2-1/8" deep or larger for telecommunications and CATV). Use only in recessed interior applications or non-finished interior applications.
- 2.5.2 Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover. Use in exterior applications and interior finished surface mounted applications.
- 2.5.3 Small Sheet Metal Pull and Junction Boxes: NEMA OS 1. Use only in flush interior applications or non-finished interior applications.
- 2.5.4 Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover. Use in exterior applications and interior finished surface mounted applications.
- 2.5.5 Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
- 2.5.6 Metal Enclosures: Galvanized steel, finished inside and out with manufacturer's standard enamel.
- 2.5.7 Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.
- 2.5.8 Exterior In-ground Junction Boxes: UL listed, polymer concrete construction, flared-wall, heavy duty cover (15,000 lbs over a 10" square), open bottom construction. Equivalent to Quazite "PG" style. Size as required or as indicated on the drawings, whichever is bigger.

2.6 Conductors

- 2.6.1 Conductors, No. 10 AWG and Smaller: 98% conductivity solid or stranded copper.
- 2.6.2 Conductors, Larger Than No. 10 AWG: 98% conductivity stranded copper.
- 2.6.3 Insulation: Dual rated THHN/THWN unless noted otherwise on the Drawings. Exception: Conductors for fire pumps and associated jockey pumps which shall be RHH 2 hour rated UL listed.
- 2.6.4 Low voltage Cables: Provide plenum rated where required.
- 2.6.5 Wire Connectors and Splices: Connectors for 600-volt conductors Size No. 18 to No. 6 AWG shall be pressure type, spring connectors. Use 600 volt splicer-reducer pressure connectors for copper conductors to 500 KCMIL. Use rectangular, solderless pressure connectors or split bolt-copper alloy connectors for copper conductors to 1000 KCMIL.

2.7 Supporting Devices

- 2.7.1 Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having

jurisdiction.

- 2.7.2 Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- 2.7.3 Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs.
 - 2.7.3.1 Channel Thickness: Selected to suit structural loading.
 - 2.7.3.2 Fittings and Accessories: Products of the same manufacturer as channel supports.
- 2.7.4 Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- 2.7.5 Conduit Straps: All conduit shall be secured with two hole galvanized straps where the following conditions exist:
 - 2.7.5.1 All exterior locations.
 - 2.7.5.2 All interior locations other than mechanical and electrical rooms where the conduit is below 10'. Conduit concealed in wall finishes and ceilings may use single hole strap if allowed by NEC.
 - 2.7.5.3 All other locations not listed above and approved by the NEC may use single hole galvanized straps.
 - 2.7.5.4 Single hole or double hole straps may not be used on direct grade. All conduits on grade shall be mounted to galvanized strut and properly attached and anchored.
- 2.7.6 Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- 2.7.7 Expansion Anchors: Carbon-steel wedge or sleeve type.
- 2.7.8 Toggle Bolts: All-steel springhead type.
- 2.8 Concrete Bases
 - 2.8.1 Concrete Forms and Reinforcement Materials: Shall be provided for all floor mounted electrical equipment including, but not limited to: switchboards, transformers, etc. Concrete bases and structural steel to support this Division's equipment and raceways, and not specifically shown on Structural or Architectural Drawings shall be furnished by the Contractor whose equipment or raceways is to be supported. Provide a raised reinforced 4" concrete base for all floor supported equipment. Equipment installed outdoors on concrete slabs shall be provided with a 4" raised concrete base. Pad shall exceed the equipment's footprint by 4" on all sides.
 - 2.8.2 Concrete: 3000-psi (20.7-MPa), 28-day compressive strength.
- 2.9 Touchup Paint
 - 2.9.1 For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

2.9.2 Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

2.10 Equipment Backboards

2.10.1 Equipment Backboards shall be exterior grade 3/4" plywood. Paint backboard with two coats of fire retardant gray paint on all six sides before mounting. Exposed side of plywood shall be smooth interior grade. A copper ground bus shall be supplied with each backboard. The ground bus shall terminate the #6 AWG ground wire provided from the electrical system. Locate equipment backboards where indicated on the Drawings. Install straight and plumb. Secure to structure using screws, toggle bolts or masonry anchors. DO NOT use plastic or wood plugs in masonry or concrete. Do not install combustible backboards in air handling space, plenums or where prohibited by the local governing authority.

3 EXECUTION

3.1 Electrical Equipment Installation

3.1.1 Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

3.1.2 Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated. Materials and equipment shall be installed in a neat and workmanlike manner according to the standards of the industry. Materials and equipment installed and not meeting the standards of the industry may be rejected and required to be removed and reinstalled by the Contractor at no additional cost to the Owner. Minor location changes from those indicated may be necessary so that work can conform with the building as constructed, to fit work of other trades or to comply with the rules of authorities having jurisdiction. Refer to structural drawings for framed openings for raceways, etc., in floors and roofs. Contractor shall be responsible for locating and providing proper dimensions for all required electrical openings.

3.1.3 Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

3.1.4 Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 Raceway Application

3.2.1 Outdoors

3.2.1.1 Use the following raceways for outdoor installations:

3.2.1.1.1 Exposed: RGS.

3.2.1.1.2 Concealed: RGS.

3.2.1.1.3 Underground: RGS. Feeders and branch circuit raceways installed below grade equal to and greater than 3/4" may be PVC, at the contractor's option. If PVC is used underground or below slab, elbows and risers through grade or slab shall be RGS, except as listed below in paragraph

titled "Special PVC Requirements". All exposed raceways penetrating concrete slab shall be rigid metal conduit. Communication raceways shall be run overhead within the building except for connection to floor boxes. Any raceway not meeting this requirement shall be replaced at the contractor's expense. Additional construction time and compensation for the correction of the deficiency will not be allowed. RGS installed underground shall be painted with two coats of alkali and acid resistant paint such as bitumastic or equal. Coating shall not be diluted and shall completely cover conduit.

3.2.1.1.4 Connection to Vibrating Equipment: LFMC.

3.2.1.1.5 Provide sealing fittings, or properly seal the conduit system, to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant temperature rooms, air conditioned spaces, building exterior walls, roofs or similar spaces.

3.2.1.1.6 Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

3.2.2 Indoors

3.2.2.1 Use the following raceways for indoor installations:

3.2.2.1.1 Exposed: RGS except EMT is acceptable in mechanical and electrical rooms above 6' AFF. Conduit may be exposed in equipment rooms, vertical chases, mechanical and electrical rooms, other similar spaces not normally habitable or exposed to public view, and where electrical drawings specifically note "exposed conduit."

3.2.2.1.2 Concealed: EMT.

3.2.2.1.3 Connection to Mechanical, Plumbing and Fire Protection Equipment: LFMC; exceptions: controls not mounted on equipment, which shall comply with 3.2.2.1 above; and small air handling units such as variable air volume units and air terminal units mounted above ceilings outside mechanical rooms, which shall be FMC.

3.2.2.1.4 Connection to Vibrating Equipment: FMC, except as listed in 3.2.2.1.3.

3.2.2.1.5 Damp or Wet Locations: RGS.

3.2.2.1.6 Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.

3.2.2.1.7 Do not use PVC coated flex conduit in plenums, including air streams inside air handler units. Use FMC instead.

3.2.3 Hazardous Locations

3.2.3.1 Use the following raceways for hazardous installations:

3.2.3.1.1 Raceways in hazardous areas shall be rigid metal conduit.

3.2.3.1.2 Install UL approved sealing fittings that prevent passage of explosive vapors, in hazardous areas equipped with explosive proof lighting fixtures, switches, and receptacles as required by the

NEC.

3.3 Raceway Installation

3.3.1 General:

- 3.3.1.1 Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.
- 3.3.1.2 Install raceways and cables at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.
- 3.3.1.3 Conductors shall not be installed until conduit system is complete. Bending radius of insulated wire or cable shall not be less than the minimum recommended by wire or cable manufacturer. Maximum pulling tension of any wire or cable shall not exceed manufacturer's recommended values. Do not injure insulation while installing wire in conduits.
- 3.3.1.4 Use temporary raceway caps to prevent foreign matter from entering.
- 3.3.1.5 Provide an equipment grounding conductor which shall be separate from the electrical system neutral conductor. See corresponding specification section.
- 3.3.1.6 Make conduit bends and offsets so inside diameter is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- 3.3.1.7 Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.
- 3.3.1.8 Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.
- 3.3.1.9 Install pull wires in empty raceways. Use No.14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.
- 3.3.1.10 Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 72-inch (1830-mm) LFMC. Install separate ground conductor across flexible connections.
- 3.3.1.11 Line voltage cables <600v: Provide colored insulation or phase tape at all terminations and pull through accessible junction box and cabinet locations.

3.3.2 Raceways in Concrete Slabs

- 3.3.2.1 Install raceways embedded in slabs in middle third of slab thickness where practical, and leave

at least 1-inch (25-mm) concrete cover.

3.3.2.2 Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

3.3.2.3 Space raceways laterally to prevent voids in concrete.

3.3.2.4 Install conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.

3.3.2.5 Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit or rigid steel conduit before rising above floor.

3.3.3 Special PVC Requirements

3.3.3.1 Floor Penetrations: Rigid metallic conduit for all exposed conduits, regardless of size and concealed conduits greater than 1 ½". Schedule 40 PVC for conduits less than 1 ½" concealed in walls. All conduit concealed by floor mounted equipment may be schedule 40 PVC (if less than 1 ½") or rigid metallic conduit (if 1 ½" or greater).

3.3.3.2 Bends: Conduits less than 1 ½": Conduit elbows may be either rigid non-metallic or non-corrosive rigid metallic conduit. In circuit runs exceeding 50', all bends shall be non-corrosive rigid metallic conduit. Bends may be factory or field fabricated using manufacturer approved heat boxes. Field fabricated bends using blowtorch are not acceptable.

3.3.3.3 Conduits 1 ½" and larger: Conduit elbows shall be rigid non-corrosive metallic conduit only. Schedule 40 PVC elbows shall not be used.

3.3.3.4 Minimum Size: Minimum size of PVC conduit to be installed below slab shall be 3/4".

3.3.3.5 Jointing: Pipe and fittings shall be cement welded or threaded (only for Schedule 80 conduit) and made watertight. All joints shall be cleaned with solvent or sanded smooth prior to application of cement.

3.3.4 Boxes

3.3.4.1 Attach boxes to concrete formwork, or to other surrounding building material. Provide additional junction and pull boxes where injury to insulation or deformation of wire would occur due to excessive pulling resistance. When several feeders pass through a common pull box, tag each feeder separately, indicating electrical characteristics and destination.

3.3.4.2 Boxes shall be accurately located. Consult Architectural plans for dimensions.

3.3.4.3 Mount boxes in the course nearest to the height specified when installed in finished block, brick or tile walls.

3.3.4.4 Boxes for use with raceway systems shall be minimum 1 ½ inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be minimum 4 inches square, except 4-by-2 inch boxes may be used where only one

raceway enters outlet.

- 3.3.4.5 Pull boxes shall be at least the minimum size required by NFPA 70 and of code-gauge galvanized sheet steel, or compatible with nonmetallic raceway systems, except where cast-metal boxes are required in locations specified herein. Furnish boxes with screw-fastened covers. Where several feeders pass through a common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.
- 3.3.4.6 Extension rings shall not be used, except when required on device boxes in walls and ceilings where standard mud rings, tile rings, masonry rings, etc will not work with the specific device type (for example: some manufacturer's fire alarm system horn/strobe devices require extension rings in masonry walls). Any extension rings found not meeting this requirement shall be removed and replaced with appropriately sized boxes at the contractor's expense. The intent of this requirement is to have the contractor plan the raceway system out ahead of time. A well planned and designed raceway system shall have boxes sized appropriately without the need for extension rings.
- 3.3.4.7 Recessed Installation: Boxes and covers shall be installed so that the covers are flush with the finished surfaces. Boxes in masonry or tile construction shall have masonry boxes or boxes with square cut tile covers. Do not cut concrete block through its entirety in order to accommodate any type box. "Handy" boxes shall not be used.
- 3.3.4.8 Boxes in Partitions: Through type boxes are not permitted except where shown on electrical drawings. Recessed outlet boxes, cabinets, consoles, etc., when shown located back-to-back shall be provided with ½" fiberglass insulation between the boxes.

3.4 Wiring Methods for Power, Lighting, and Control Circuits

- 3.4.1 Feeders: Type THHN/THWN insulated conductors in raceway.
- 3.4.2 Underground Feeders and Branch Circuits: Type THWN insulated conductors in raceway.
- 3.4.3 Branch Circuits: Type THHN/THWN insulated conductors in raceway.
- 3.4.4 Remote-Control Signaling and Power-Limited Circuits: Type THHN/THWN insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

3.5 Wiring Installation

- 3.5.1 Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- 3.5.2 Wire Pulling Lubrication: Shall be used when any wire is pulled by mechanical means. Wire and cable shall be carefully handled during installation. Soap flakes or vegetable soaps shall not be used for lubrication.
- 3.5.3 Install wiring at outlets with at least 12 inches (300 mm) of slack conductor at each outlet.
- 3.5.4 Connect outlet and component connections to wiring systems and to ground. Tighten electrical

connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.5.5 Provide dedicated neutrals for all 120V and 277V circuits.

3.5.6 Except for control wiring, the minimum size wire shall be No. 12 AWG. The following indicates the required minimum wire sizes for branch circuits to achieve <3% voltage drop at full load. The contractor shall verify all circuit lengths prior to pulling wire. Wires found to be smaller than those indicated below shall be removed and repulled (including increased conduit size and/or junction box sizes as required) with the correct wire at the contractor's expense. The distances indicated below are to be measured to the center of the load.

3.5.6.1 For all 120V lighting and receptacle circuits that are longer than 50' and less than 100', the minimum wire size shall be No. 10 AWG.

3.5.6.2 For all 120V lighting and receptacle circuits that are longer than 100' and less than 150', the minimum wire size shall be No. 8 AWG.

3.5.6.3 For all 120V lighting and receptacle circuits that are longer than 150' , the minimum wire size shall be No. 6 AWG.

3.6 Expansion Joints

3.6.1 Conduits 3" and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install couplings in accordance with the manufacturers' recommendations.

3.6.2 Provide conduits smaller than three inches with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5" vertical drop midway between end. Flexible conduit shall have a green copper ground-bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for three inches and larger conduits are acceptable.

3.6.3 Expansion fittings shall be provided for raceways to compensate for thermal expansion and contraction in conduit runs 200 feet or greater and at building expansion joints. Bonding jumpers shall be provided for electrical continuity of the raceway system at the expansion fittings.

3.7 Electrical Supporting Device Application

3.7.1 Damp Locations and Outdoors: Hot-dip galvanized materials.

3.7.2 Dry Locations: Steel materials.

3.7.3 Support Clamps for PVC Raceways: Click-type clamp system.

3.7.4 Selection of Supports: Comply with manufacturer's written instructions.

3.7.5 Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3.8 Support Installation

- 3.8.1 Install support devices to securely and permanently fasten and support electrical components.
- 3.8.2 Support no electrical work from piping, ductwork, etc. Where metal decking is used, provide supports independent of decking so that loads will not be transferred to decking. Drill through decking and secure supports to concrete slab.
- 3.8.3 Conduit through Slab Supports: Conduit supports for conduits routed from below grade up through concrete slabs shall be solid, metallic type. Metallic conduit shall not be used to support conduits through slab. After concrete slab has been poured and set, supports shall be cut flush with slab.
- 3.8.4 Vertical conduit inside building shall be supported at each floor level and at 10'0" intervals.
- 3.8.5 Support conduit within one foot of changes of direction, and within one foot of each enclosure to which it is connected.
- 3.8.6 Electrical devices in lay-in and gypsum board ceilings: Coordinate location of electrical outlets with architectural features of the building and with the equipment of other trades. Boxes or devices mounted between bar joists or "T" bars shall be supported from two bars or joists. Devices and associated boxes shall not be supported by the lay-in tiles or gypsum boards.
- 3.8.7 Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- 3.8.8 Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- 3.8.9 Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- 3.8.10 Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- 3.8.11 Install 1/4-inch- (6-mm-) diameter or larger threaded steel hanger rods, unless otherwise indicated.
- 3.8.12 Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- 3.8.13 Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- 3.8.14 Simultaneously install vertical conductor supports with conductors.
- 3.8.15 Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used,

attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.

- 3.8.16 Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- 3.8.17 Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- 3.8.18 Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
 - 3.8.18.1 Wood: Fasten with wood screws or screw-type nails.
 - 3.8.18.2 Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
 - 3.8.18.3 New Concrete: Concrete inserts with machine screws and bolts.
 - 3.8.18.4 Existing Concrete: Expansion bolts.
 - 3.8.18.5 Steel: Welded threaded studs or spring-tension clamps on steel.
 - 3.8.18.6 Field Welding: Comply with AWS D1.1.
 - 3.8.18.7 Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
 - 3.8.18.8 Light Steel: Sheet-metal screws.
 - 3.8.18.9 Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

END OF SECTION

SECTION 16101/ELECTRICAL IDENTIFICATION1 GENERAL1.1 Related Documents

1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

1.2.1 This Section includes the following:

1.2.1.1 Identification for raceway.

1.2.1.2 Identification for conductors and communication and control cable.

1.2.1.3 Underground-line warning tape.

1.2.1.4 Warning labels and signs.

1.2.1.5 Instruction signs.

1.2.1.6 Equipment identification labels.

1.2.1.7 Miscellaneous identification products.

1.3 Quality Assurance

1.3.1 Comply with ANSI A13.1 and ANSI C2.

1.3.2 Comply with NFPA 70.

1.3.3 Comply with 29 CFR 1910.145.

1.4 Coordination

1.4.1 Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

1.4.2 Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

1.4.3 Coordinate installation of identifying devices with location of access panels and doors.

1.4.4 Install identifying devices before installing acoustical ceilings and similar concealment.

1.5 Approval Submittals:

1.5.1 Product Data: For each electrical identification product indicated.

1.5.2 Identification Schedule: An index of the nomenclature and color coding scheme of electrical equipment and system components used in identification signs, labels and colors.

2 PRODUCTS

2.1 Raceway Identification:

2.1.1 Paint: Semigloss acrylic-enamel.

2.1.2 Marker for circuit identification on box covers: Permanent, waterproof, black ink marker (exception : brown and black painted covers which shall use permanent, waterproof, white paint based marker).

2.2 Conductor and Cable Identification Materials:

2.2.1 Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

2.2.2 Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2.3 Write-On Tags: Polyester tag, 0.01 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

2.2.3.1 Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 Underground-line Warning Tape:

2.3.1 Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

2.3.1.1 Not less than 6 inches wide by 5.5 mils thick.

2.3.1.2 Compounded for permanent direct-burial service.

2.3.1.3 Embedded continuous metallic strip or core 3.5 mils thick.

2.3.1.4 Printed legend shall indicate type of underground line.

2.4 Warning Labels and Signs:

2.4.1 Comply with NFPA 70 and 29 CFR 1910.145.

- 2.4.2 Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- 2.4.3 Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.
- 2.4.4 Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.
- 2.4.5 Warning label and sign shall include, but are not limited to, the following legends:
- 2.4.6 Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
- 2.5 Instruction Signs:
- 2.5.1 Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
- 2.5.2 Engraved legend with black letters on white face.
- 2.5.3 Punched or drilled for mechanical fasteners.
- 2.5.4 Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- 2.6 Equipment Identification Labels:
- 2.6.1 Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. White letters on a red background for Emergency and Optional Standby systems.
- 2.7 Miscellaneous Identification Products:
- 2.7.1 Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
- 2.7.2 Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.
- 3 EXECUTION
- 3.1 Accessible Raceways 600 V or Less, for Service, Feeder, and Branch Circuits:
- 3.1.1 Identify interior raceway systems with paint as follows:
- 3.1.1.1 Conduits: paint all couplings per the color coding below.

3.1.1.2 Junction Boxes:

3.1.1.2.1 Paint all junction and pull box covers per the color coding below.

3.1.1.2.2 For covers containing branch circuits: after painting the cover the appropriate color, hand write the panelboard/circuit number contained in the box (i.e. 2P1-15,17,19).

3.1.1.2.3 For covers containing feeder circuits: after painting the cover the appropriate color, hand write the feeding panel and load panel (i.e. 4D1 to 2P1A).

3.1.2 Coupling and box cover colors as follows:

3.1.2.1 120/208 Volt Systems: Black.

3.2 Auxiliary Systems:

3.2.1 Identify interior raceway systems with paint as follows:

3.2.1.1 Conduits: paint all couplings per the color coding below.

3.3 Conductors:

3.3.1 Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

3.3.2 Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3.3.3 Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

3.3.4 Power-Circuit Conductor Identification: For conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

3.3.5 Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.

3.3.6 Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

3.4 Locations of Underground Lines: Identify with underground-line warning tape for power and lighting. Install underground-line warning tape for both direct-buried cables and cables in raceway.

- 3.5 Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
- 3.6 Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
 - 3.6.1 Controls with external control power connections.
- 3.7 Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- 3.8 Instruction Signs:
 - 3.8.1 Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- 3.9 Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
- 3.10 Labeling Instructions:
 - 3.10.1 Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a with 1/4-inch high letters on 1-inch high label.
 - 3.10.2 Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - 3.10.3 Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - 3.10.4 Equipment to Be Labeled:
 - 3.10.4.1 Panelboards, electrical cabinets, and enclosures.
 - 3.10.4.2 Access doors and panels for concealed electrical items.
 - 3.10.4.3 Disconnect switches.
 - 3.10.4.4 Enclosed circuit breakers.
- 3.11 Installation:
 - 3.11.1 Verify identity of each item before installing identification products.

- 3.11.2 Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- 3.11.3 Apply identification devices to surfaces that require finish after completing finish work.
- 3.11.4 Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- 3.11.5 Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- 3.11.6 Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
- 3.11.7 Colors for 208/120-V Circuits:
 - 3.11.7.1 Phase A: Black.
 - 3.11.7.2 Phase B: Red.
 - 3.11.7.3 Phase C: Blue.
 - 3.11.7.4 Neutral: White.
 - 3.11.7.5 Grounding Conductor: Green.
- 3.11.8 Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- 3.11.9 Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 18" to 30" above the line and not less than 6" below grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
- 3.11.10 Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.
- 3.11.11 Identification Schedule: Prior to Substantial Completion Inspection provide one framed and under glass 11" x 17" color copy of the approved Identification Schedule in each electrical room.

END OF SECTION

SECTION 16103 / GROUNDING AND BONDING1 GENERAL1.1 Related Documents

1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

1.2.1 This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 Approval Submittals

1.3.1 Product Data: For each type of product indicated.

1.3.2 Field Test Reports: Submit written test reports to include the following:

1.3.2.1 Test procedures used.

1.3.2.2 Test results that comply with requirements.

1.3.2.3 Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.4 Quality Assurance

1.4.1 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4.1.1 Comply with UL 467.

1.5 Approval Submittals:

1.5.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of product indicated.

2 PRODUCTS

2.1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2.1.1 Grounding Conductors, Cables, Connectors, and Rods:

2.1.1.1 Erico Inc.; Electrical Products Group.

2.1.1.2 Thermoweld, Inc.

2.2 Grounding Conductors

2.2.1 For insulated conductors, comply with Division 16 Section "Conductors and Cables."

2.2.2 Material: copper.

2.2.3 Equipment Grounding Conductors: Insulated with green-colored insulation.

2.2.4 Grounding Electrode Conductors: Stranded cable.

2.2.5 Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

2.2.6 Bare Copper Conductors: Comply with the following:

2.2.6.1 Solid Conductors: ASTM B 3.

2.3 Connector Products

2.3.1 Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

2.3.2 Bolted Connectors: Copper or bronze bolted-pressure-type connectors, or compression type. Do not use below grade.

2.3.3 Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions. For use in below grade applications.

2.4 Grounding Electrodes:

2.4.1 Ground Rods: Copper clad steel, sectional type, 3/4" x 10'

3 EXECUTION

3.1 Application

3.1.1 In raceways, use insulated equipment grounding conductors.

3.1.2 Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.

3.1.3 Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

3.2 Equipment Grounding Conductors

3.2.1 Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

3.2.2 Install equipment grounding conductors in all feeders and circuits.

3.3 Installation

3.3.1 Ground Rods:

3.3.1.1 At the main electrical service entrance, install rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.

3.3.1.2 Drive ground rods until tops are 6 inches below finished floor or final grade, unless otherwise indicated.

3.3.1.3 Interconnect ground rods with grounding electrode conductors. Use exothermic welds, and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

3.3.2 Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

3.3.3 Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

3.4 Connections

3.4.1 General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

3.4.1.1 Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.

3.4.1.2 Make connections with clean, bare metal at points of contact.

3.4.1.3 Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.4.2 Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable. Inspect molds prior to use and discard if deformed.

3.4.3 Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

3.4.4 Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding

- bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- 3.4.5 Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- 3.4.6 Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- 3.4.7 Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

END OF SECTION

SECTION 16105/EXCAVATION AND BACKFILL1 GENERAL1.1 Related Documents

- 1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.1.2 Review all project Drawings to be aware of conditions affecting work herein.

2 PRODUCTS

- 2.1 Sand: Clean, hard, uncoated grains free from organic matter or other deleterious substances. Sand for backfill shall be of a grade equal to mortar sand, with 95% passing a No. 8 sieve, and not more than 8% passing a No. 100 sieve.
- 2.2 Gravel: Clean, well-graded hard stone or lime rock gravel, free from organic material. Size range to be from No. 4 screen retentions to 1".
- 2.3 Earth: Must be free of stones, wood, roots or rubbish.
- 2.4 Underground-line Warning Tape: See specifications Section 16101 / Electrical Identification.

3 EXECUTION

- 3.1 Ditching and Excavation: Shall be performed by hand wherever the possibility of encountering obstacles or any existing utility lines. The Contractor will be totally responsible to insure that no utility or service interruptions shall be caused and that no existing utilities or obstructions will prohibit installations of service under this Contract at proper grade and location. Where clear and unobstructed areas are to be excavated, appropriate machine excavation methods may be employed. Avoid use of machine excavations within the limits of the building lines except when machine weights and operation will not damage sub-surface structural components or piping.
- 3.2 Bedding: Excavate to bottom grade of raceway to be installed, and shape bed of undisturbed earth to contour of conduit for a width of at least 5% of the conduit diameter. If earth conditions necessitate excavation below raceway grade, bring the bed up to the proper elevation with clean, dry sand deposited in 6" layers and firmly tamped by mechanical means. If sub-cut exceeds 12" or if bed is of an unstable nature, a 6" minimum layer of rock will be required before sand bedding begins.
- 3.3 Placing: Conduit shall be carefully handled into place in the excavation. Avoid knocking loose soil from the banks of the trench into the conduit bed. Coated conduit shall have special handling slings to prevent damage to the coating. All holidays in the conduit coating shall be touched in before beginning back filling.
- 3.4 Backfilling: Deposit earth or sand carefully in 6" layers, maintaining adequate side support. Compact fill in 6" layers, using mechanical means up to the top elevation of the conduit and 12" layers to finish grade.

- 3.5 Identification: Provide identifying metalized plastic warning tape above conduit. Replace surface to the original condition, i.e., sodding, sprigging, and fine grading.
- 3.6 Excavation shall be maintained in satisfactory condition during the progress of the work. Sub-surface structures shall be constructed in adequately sized excavations and dewatering equipment shall be installed and properly maintained. Shoring shall be employed in the event of unstable soil conditions, and in all cases to protect materials and personnel from injury.
- 3.7 Conduits to be installed below the footings or foundations shall be installed prior to the installation of the footings. All soil shall be compacted to meet the structural requirements for the footings. If it is not possible to install the conduit prior to pouring of the footings, it shall be necessary for the contractor to provide a bridge footing to span the excavation plus 2 feet on either side of the excavation. The footing modifications shall be approved prior to installation by the Structural Engineer.

END OF SECTION

SECTION 16107/SERVICE ENTRANCE METHODS AND MATERIALS - UNDERGROUND1 GENERAL

1.1 Related Documents

1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.1.2 Division-16 Basic Electrical Materials and Methods Sections apply to work of this Section.

1.1.3 Review all project drawings to be aware of conditions affecting work herein.

2 PRODUCTS

2.1 Materials for this section are specified in the Section "Basic Materials and Methods."

3 EXECUTION

3.1 Installation shall comply with the requirements of the Utilities Company and the applicable paragraphs in Article "3.0 EXECUTION" of the Section "Basic Materials and Methods."

3.2 Comply with NEC 70 - Underground Services.

3.3 Comply with the Section "Excavation and Backfill."

3.4 The electrical contractor shall provide the raceways and service conductors from the reinforced concrete transformer pad to the service equipment as indicated on the Drawings.

3.5 The Electrical Contractor shall provide the raceways from the transformer pad to the meter cabinet. Minimum conduit size is 1".

3.6 Raceways shall be schedule 40 PVC or bitumastic coated rigid metal conduit for straight lengths and bitumastic coated rigid metal conduit for any bends of 45 or 90 degrees.

3.7 The 45 or 90-degree bends shall have a minimum radius of 36 inches.

3.8 Rigid metal conduit shall receive two undiluted coats of bitumastic free from holidays and pinholes.

3.9 The Electrical Contractor shall provide 200# test poly cord in each spare raceway.

END OF SECTION

SECTION 16112/FUSES 600 VOLTS AND BELOW1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this Section.
- 1.2 Division-16 Basic Electrical Materials and Methods Sections apply to work of this Section.
- 1.3 Approval Submittals:
- 1.3.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of product indicated.

2 PRODUCTS

- 2.1 Acceptable Producers: Buss, Farraz Shamut, Littlefuse, Siemens.
- 2.2 General: Products listed herein are common to various Divisions and Specification Sections for this project and as shown on this project's Drawings.
- 2.3 All fuses furnished shall be by the same producer.
- 2.4 Voltage Rating:
- 2.4.1 Provide 600 volt fuses for 277/480 volt systems.
- 2.4.2 Provide 250 volt fuses for 120, 208 and 240 volt systems.
- 2.5 Ampere Ratings: Ampere ratings of fuses shall be as indicated on the Drawings.
- 2.6 Interrupting Ratings: Interrupting ratings of fuses shall be as indicated on the Drawings.
- 2.7 Current Limitation: Current limiting fuses shall be provided where indicated by C/L on the Drawings.
- 2.8 Rejection Fuse Clips: Provide fuse with rejection feature for switches required to have the rejection feature as indicated on the Drawings.
- 2.9 Class of Fuses: Provide fuses of Class J, K, L or R.

3 EXECUTION

- 3.1 Coordinate fuse type and ampacity with fuse holder.
- 3.2 Provide 10% spare fusing with a minimum of three sets spare (including new fusing for each of the three phases) of the amount installed, based on the different voltages, amperage ratings, and types of fusing installed. Spare fusing shall be provided within weatherproof containers for long-term storage (such as in ammo cans). Spray paint container with the wording "Spare Fuses" on the side.

END OF SECTION

SECTION 16120/ENCLOSED SWITCHES AND CIRCUIT BREAKERS ○1 GENERAL1.1 Related Documents

1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 Summary

1.2.1 This Section includes the following individually mounted, enclosed switches and circuit breakers:

1.2.1.1 Fusible switches.

1.2.1.2 Nonfusible switches.

1.3 Definitions

1.3.1 GFCI: Ground-fault circuit interrupter.

1.3.2 HD: Heavy duty.

1.3.3 RMS: Root mean square.

1.3.4 SPDT: Single pole, double throw.

1.4 Quality Assurance

1.4.1 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4.2 Comply with NFPA 70.

1.4.3 All products shall be UL listed.

1.4.4 Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.5 Project Conditions

1.5.1 Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1.5.1.1 Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).

1.5.1.2 Altitude: Not exceeding 6600 feet (2010 m).

1.6 Coordination

1.6.1 Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.7 Approval Submittals:

1.7.1 Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1.7.1.1 Enclosure types and details for types other than NEMA 250, Type 1.

1.7.1.2 Time-current curves, including selectable ranges for each type of circuit breaker.

1.7.1.3 Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.7.1.4 Current and voltage ratings.

1.7.1.5 Short-circuit current rating.

1.7.1.6 Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components. ○

1.8 O&M Data Submittals:

1.8.1 Submit manufacturer's maintenance data including parts lists. Include these data, a copy of approval submittals (product data & shop drawings) in O&M manual.

2 PRODUCTS

2.1 Manufacturers

2.1.1 Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.1.1.1 Square D Co.

2.1.1.2 Eaton Corp.; Cutler-Hammer Products.

2.1.1.3 General Electric Co.; Electrical Distribution & Control Division.

2.1.1.4 Siemens.

2.2 Fusible and Nonfusible Switches

2.2.1 Fusible Switch: NEMA KS 1, Type Heavy Duty, with equipment ground kit, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position. All fusible switches rated 100 thru 600 amperes at 240 volts, and 30 thru 600 amperes at 600 volts, shall have the capability of field conversion from standard Class H fuse spacing to Class J fuse spacing without affecting the UL listing. The switch also must accept Class R fuses and have field installable UL listed rejection feature to reject all fuses except Class R. UL listed short circuit ratings, when equipped with Class R fuses shall be 200,000 ampere RMS symmetrical. 800 and 1200 ampere switches shall have provisions for Class L fuses.

2.2.2 Nonfusible Switch: NEMA KS 1, Type Heavy Duty, with equipment ground kit, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

2.2.3 Accessories:

2.2.3.1 Equipment Ground Kit: Copper material internally mounted and labeled for copper ground conductors.

2.3 Enclosures

2.3.1 NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location and shall be dead front type.

2.3.1.1 Outdoor Locations: NEMA 250, Type 3R.

2.3.1.2 Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2.3.1.3 Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

3 EXECUTION

3.1 Examination

3.1.1 Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

3.1.2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

3.2.1 Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

3.2.2 Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

- 3.2.3 Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- 3.3 Identification
 - 3.3.1 Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Basic Electrical Materials and Methods."
 - 3.3.2 Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 16 Section "Basic Electrical Materials and Methods."
- 3.4 Adjusting
 - 3.4.1 Set field-adjustable switches and circuit-breaker trip ranges.
- 3.5 Cleaning
 - 3.5.1 On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
 - 3.5.2 Inspect exposed surfaces and repair damaged finishes.

END OF SECTION

SECTION 16150/LIGHTING CONTROL DEVICES1 GENERAL1.1 Related Documents

1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

1.2.1 This Section includes the following lighting control devices:

1.2.1.1 Photoelectric switches.

1.3 Definitions

1.3.1 LED: Light-emitting diode.

1.4 Quality Assurance

1.4.1 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4.2 All products shall be UL listed.

1.5 Coordination

1.5.1 Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures.

1.6 Approval Submittals:

1.6.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of product indicated.

1.6.2 Shop Drawings:

1.6.2.1 Show installation details for light-level sensors.

1.6.2.2 Interconnection diagrams showing field-installed wiring.

1.7 Test Reports and Verification Submittals:

1.7.1 Training: Submit letter verifying that Owner training has been received by factory representative.

1.7.2 Perform the following field tests and inspections and prepare test reports:

- 1.7.2.1 Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements. Verify actuation of each sensor and adjust time delays. Set sensitivities, time delays, etc as required for each specific device based on the actual conditions of the environment in which it exists.
- 1.8 O&M Data Submittals:
 - 1.8.1 Submit manufacturer's maintenance data including parts lists. Include these data, a copy of approval submittals (product data & shop drawings) in O&M manual.
- 2 PRODUCTS
 - 2.1 Manufacturers
 - 2.1.1 Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2.1.2 Manufacturers:
 - 2.1.2.1 Intermatic, Inc.
 - 2.1.2.2 Paragon Electric Co.
 - 2.1.2.3 Tork.
 - 2.1.3 Description: Solid state, with dry contacts rated for 1800-VA tungsten, to operate connected relay, contactor coils, microprocessor input, and complying with UL 773A.
 - 2.1.3.1 Light-Level Monitoring Range: 1.5 to 10 fc (16 to 108 lx), with an adjustment for turn-on and turn-off levels within that range and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
 - 2.1.3.2 Time Delay: 15-second minimum, to prevent false operation.
 - 2.1.3.3 Surge Protection: Metal-oxide varistor type, complying with IEEE C62.41 for Category A1 locations.
 - 2.1.3.4 Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the North sky exposure.
 - 2.2 Conductors and Cables
 - 2.2.1 Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying with Division 16 Section "Basic Electrical Materials and Methods."

3 EXECUTION

3.1 Sensor Installation

- 3.1.1 Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 Wiring Installation

- 3.2.1 Wiring Method: Comply with Division 16 Section "Basic Electrical Materials and Methods."

- 3.2.1.1 Minimum conduit size shall be ½ inch (13 mm).

- 3.2.2 Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

- 3.2.3 Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.

- 3.2.4 Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

- 3.2.5 Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

- 3.2.6 Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 Identification

- 3.3.1 Identify components and power and control wiring according to Division 16 Section "Basic Electrical Materials and Methods."

3.4 Adjusting

- 3.4.1 Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

END OF SECTION

SECTION 16170 / WIRING DEVICES1 GENERAL1.1 Related Documents

1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

1.2.1 This Section includes the following:

1.2.1.1 Single and duplex receptacles, ground-fault circuit interrupters, integral surge suppression units, and isolated-ground receptacles.

1.2.1.2 Single and double-pole snap switches and dimmer switches.

1.2.1.3 Device wall plates.

1.2.1.4 Pin and sleeve connectors and receptacles.

1.2.1.5 Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 Definitions

1.3.1 EMI: Electromagnetic interference.

1.3.2 GFCI: Ground-fault circuit interrupter.

1.3.3 PVC: Polyvinyl chloride.

1.3.4 RFI: Radio-frequency interference.

1.3.5 TVSS: Transient voltage surge suppressor.

1.3.6 UTP: Unshielded twisted pair.

1.4 Quality Assurance

1.4.1 Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

1.4.2 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4.3 Comply with NFPA 70.

1.4.4 UL Listed.

1.5 Approval Submittals:

1.5.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each product provided.

2 PRODUCTS

2.1 Manufacturers

2.1.1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2.1.1.1 Wiring Devices:

2.1.1.1.1 Eagle Electric Manufacturing Co., Inc.

2.1.1.1.2 Hubbell Incorporated; Wiring Device-Kellems.

2.1.1.1.3 Leviton Mfg. Company Inc.

2.1.1.1.4 Pass & Seymour/Legrand; Wiring Devices Div.

2.1.1.2 Wiring Devices for Hazardous (Classified) Locations:

2.1.1.2.1 Crouse-Hinds/Cooper Industries, Inc.; Arrow Hart Wiring Devices.

2.1.1.2.2 EGS/Appleton Electric Company.

2.1.1.2.3 Killark Electric Manufacturing Co./Hubbell Incorporated.

2.1.1.3 Multioutlet Assemblies:

2.1.1.3.1 Hubbell Incorporated; Wiring Device-Kellems.

2.1.1.3.2 Wiremold Company (The).

2.1.1.3.3 Hubbell Incorporated; Wiring Device-Kellems.

2.1.1.3.4 Pass & Seymour/Legrand; Wiring Devices Div.

2.1.1.3.5 Square D/Groupe Schneider NA.

2.1.1.3.6 Thomas & Betts Corporation.

2.1.1.3.7 Wiremold Company (The).

2.2 Receptacles

- 2.2.1 Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498. Devices shall be specification grade. Use white finished devices throughout except as hereinafter noted otherwise. Hubbell HBL5262 or approved equal.
- 2.2.2 GFCI Receptacles: Straight blade, Devices shall be specification grade. Use white finished devices throughout except as hereinafter noted otherwise, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter. Hubbell GFR5262 or approved equal.

2.3 Switches

- 2.3.1 Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.
 - 2.3.1.1 Single Pole, 20 amp, 120/277 shall be Hubbell HBL1221 or approved equal.
 - 2.3.1.2 Double Pole, 20 amp, 120/277V shall be Hubbell HBL1222 or approved equal.
 - 2.3.1.3 Three-Way, 20 amp, 120/277V shall be Hubbell HBL1223 or approved equal.
 - 2.3.1.4 Four-Way, 20 amp, 120/277V shall be Hubbell HBL1224 or approved equal.
- 2.3.2 Snap Switches: Specification grade, quiet type, abuse resistant nylon toggle, color coded base, one piece rivetless copper alloy spring contact arm & terminal plate, one piece integral grounding terminal with #8 brass screw, stainless steel automatic grounding clip, back wiring, one piece rivetless copper alloy spring contact arm and terminal plate. Provide 20 amp switches for circuits less than or equal to 20 amperes. Provide 30 ampere switches for circuits exceeding 20 amperes but less than 30 amperes..

2.4 Wall Plates

- 2.4.1 Single and combination types to match corresponding wiring devices.
 - 2.4.1.1 Material for Finished Spaces: Provide UL listed one-piece device plates for outlets to suit the devices installed. Except as noted below, all wiring device plates shall be high-impact smooth nylon white. Sectional type device plates will not be permitted. Screws shall be machine-type with countersunk heads in color to match finish of plate.
 - 2.4.1.2 Material for Unfinished Spaces: Provide UL listed one-piece device plates for outlets to suit the devices installed. Except as noted below, all wiring device plates shall be high-impact smooth nylon white. Sectional type device plates will not be permitted. Screws shall be machine-type with countersunk heads in color to match finish of plate.
 - 2.4.1.3 Material for Wet Locations: Plates installed in wet locations shall be cast, gasketed and UL listed for "wet locations."

2.5 Finishes

2.5.1 Wiring Devices Connected to Normal Power System: White, unless otherwise indicated or required by NFPA 70.

2.5.2 Wiring Devices Connected to Standby Generator System: Red.

3 EXECUTION

3.1 Installation

3.1.1 Install devices and assemblies level, plumb, and square with building lines.

3.1.2 Mounting Heights: Mounting heights for receptacle outlets shall be 18" above finished floor or as indicated on the Drawings. Mounting heights for receptacles over casework shall be 7" above counter top. Verify all receptacle heights prior to rough-in. Provide a written description to the Engineer, prior to rough-in, any conflicts. The Contractor shall at his expense, be responsible for the relocation of any receptacle not installed according to these specifications.

3.1.3 Prior to roughing-in wall outlet boxes, the Contractor shall verify from general construction drawings; door swings, type of wall finishes and locations for counters and work benches. Do not scale the plans; location of devices is shown on plans in desired vicinity. The Contractor shall carefully locate devices symmetrically and in coordination with architectural features.

3.1.4 Locate light switches at doors as close as possible to door jam.

3.1.5 Switches that control remote outlets, fans, etc., shall have engraved plastic name tags indicating the outlets, fans, etc. that are controlled.

3.1.6 Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions.

3.1.7 Install unshared neutral conductors on line and load side of dimmers according to manufacturers' written instructions.

3.1.8 Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.1.9 Remove wall plates and protect devices and assemblies during painting.

3.1.10 Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 Connections

3.2.1 Ground equipment according to Division 16 Section "Grounding and Bonding".

3.2.2 Connect wiring according to Division 16 Section "Basic Electrical Materials and Methods".

3.2.3 Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 Field Quality Control

3.3.1 Perform the following field tests and inspections:

3.3.1.1 After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.

3.3.1.2 Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

3.3.1.3 Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION

SECTION 16420 / PANELBOARDS1 GENERAL1.1 Related Documents

1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

1.2.1 This Section includes the following:

1.2.1.1 Distribution panelboards.

1.2.1.2 Lighting and appliance branch-circuit panelboards.

1.3 Definitions

1.3.1 EMI: Electromagnetic interference.

1.3.2 GFCI: Ground-fault circuit interrupter.

1.3.3 RFI: Radio-frequency interference.

1.3.4 RMS: Root mean square.

1.3.5 SPDT: Single pole, double throw.

1.4 Quality Assurance:

1.4.1 Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

1.4.2 Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated.

1.4.3 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4.4 Comply with NEMA PB 1.

1.4.5 Comply with NFPA 70.

1.4.6 Panelboards shall be listed and labeled by Underwriters' Laboratories, Inc. in accordance with UL Standard 67.

1.4.7 Panelboards for use as service disconnecting means shall additionally conform to UL 869.

1.5 Project Conditions

1.5.1 Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1.5.1.1 Ambient Temperature: Not exceeding 104 deg F (40 deg C).

1.5.1.2 Altitude: Not exceeding 6600 feet (2000 m).

1.5.2 Service Conditions: NEMA PB 1, usual service conditions, as follows:

1.5.2.1 Ambient temperatures within limits specified.

1.5.2.2 Altitude not exceeding 6600 feet (2000 m).

1.6 Coordination

1.6.1 Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.6.2 Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.7 Approval Submittals:

1.7.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of:

1.7.1.1 Panelboard

1.7.1.2 Overcurrent protective device

1.7.2 Shop Drawings:

1.7.2.1 For each panelboard provide dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

1.7.2.1.1 Enclosure types and details for types other than NEMA 250, Type 1.

1.7.2.1.2 Bus configuration, current, and voltage ratings.

1.7.2.1.3 Short-circuit current rating of panelboards and overcurrent protective devices.

1.7.2.1.4 Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.7.2.1.5 Time-current curves, including selectable ranges for each type of overcurrent protective device equal to and greater than 250 amp frame.

1.7.2.1.6 Power, signal, and control wiring diagrams.

1.7.2.1.7 Panelboard schedules for installation in panelboards.

1.8 Test Reports and Verification Submittals:

1.8.1 Training: Submit letter verifying that Owner training has been received by factory representative.

1.8.2 Perform the following field tests and inspections and prepare test reports:

1.8.2.1 Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Document results.

1.8.2.1.1 Measure as directed during period of normal system loading.

1.8.2.1.2 Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.

1.8.2.1.3 After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.

1.8.2.1.4 Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

1.9 O&M Data Submittals:

1.9.1 Submit manufacturer's maintenance data including parts lists. Include these data, a copy of approval submittals (product data & shop drawings) in O&M manual.

2 PRODUCTS

2.1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2.1.1 Panelboards and Accessories:

2.1.1.1 Eaton Corporation; Cutler-Hammer Products.

2.1.1.2 General Electric Co.; Electrical Distribution & Protection Div.

2.1.1.3 Square D.

2.1.1.4 Siemens.

2.2 Panelboards

2.2.1 Enclosures: Galvanized surface-mounted cabinets. NEMA 250, Type 1 .

- 2.2.1.1 Rated for environmental conditions at installed location.
- 2.2.1.2 Outdoor Locations: NEMA 250, Type 3R.
- 2.2.1.3 Hinged Front (Indoor units only): Trim shall have a hinged inner door over the branch disconnect area secured with one or two lockable flush latches. Tools shall not be required to open the inner hinged door. There shall also be a hinged outer door that covers the gutter area secured by screws. Tools shall be required to open the outer hinged door. All locks shall be keyed alike.
- 2.2.1.4 Skirt for Surface-Mounted Panelboards: Same gauge and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
- 2.2.1.5 Gutter Extension and Barrier: Same gauge and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
- 2.2.1.6 Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- 2.2.1.7 Directory Card: Type written with transparent protective cover, mounted in metal frame, inside panelboard door.
- 2.2.1.8 Provide a plastic nameplate 1" high by 3" wide with minimum 1/4" letters indicating the panelboard identification, voltage and upstream protective device. The panelboard shall also have a nameplate affixed to the panelboard with the following information stamped therein:
 - 2.2.1.8.1 Nameplate: Manufacturer, Voltage, Ampacity, Type of Panelboard, Manufacturer's Order No. and Date, Interrupting Rating - RMS Sym.
- 2.2.2 Phase and Neutral Buses:
 - 2.2.2.1 Material: Hard-drawn copper, 98 percent conductivity.
 - 2.2.2.2 Neutral Bus: Neutral bus shall be rated 100 or 200 percent of phase bus as indicated on the drawings.
- 2.2.3 Equipment Ground Bar: Copper or tin plated copper. Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- 2.2.4 Conductor Connectors: Suitable for use with conductor material.
 - 2.2.4.1 Main and Neutral Lugs: Mechanical Compression type. Crimp not allowed.
 - 2.2.4.2 Ground Lugs and Bus Configured Terminators: Compression type.
- 2.2.5 Service Equipment Label (where indicated): UL labeled for use as service equipment for panelboards with main service disconnect switches.
- 2.2.6 Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 Panelboard Short-circuit Rating

2.3.1 Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 Distribution Panelboards

2.4.1 Main Overcurrent Protective Devices: Circuit breaker.

2.4.2 Branch Overcurrent Protective Devices: Circuit breaker.

2.5 Lighting and Appliance Branch-circuit Panelboards

2.5.1 Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

2.5.2 Overcurrent Protective Devices: Plug-in, full-module circuit breaker.

2.5.3 Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.6 Overcurrent Protective Devices

2.6.1 Circuit breakers shall be molded case with trip units of size, type and quantity shown on the drawings. The circuit breakers shall be bolt-on type, equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Paper stickers are not acceptable for individual circuit numbers. Individual circuit numbers shall be phenolic. Trip indication shall be clearly shown by the breaker handle. Provisions for additional breakers shall be such that no additional connectors will be required to add circuit breakers. Breaker terminals shall be UL listed as suitable for type and size of conductor provided for.

2.6.2 The following are general/minimum requirements. Provide features trip units, etc. per the selective coordination study as required to achieve coordination.

2.6.2.1 Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

2.6.2.2 Current-Limiting Circuit Breakers: Frame sizes 400A and smaller; let-through ratings less than NEMA FU 1, RK.

2.6.2.3 Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Unless indicated otherwise, breakers smaller than 250A frame shall be thermal-magnetic.

2.6.3 Multipole Breakers: Provide common trip-type with single operating handle. Breaker design shall be such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

3 EXECUTION

3.1 Installation

- 3.1.1 Install panelboards and accessories according to NEMA PB1.1.
- 3.1.2 Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.
- 3.1.3 Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- 3.1.4 Install overcurrent protective devices and controllers.
 - 3.1.4.1 Set field-adjustable switches and circuit-breaker trip ranges.
- 3.1.5 Install filler plates in unused spaces.
- 3.1.6 Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- 3.1.7 Provide four spare $\frac{3}{4}$ " conduits from all recessed panelboards to above accessible ceiling for future use.

3.2 Identification

- 3.2.1 Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Basic Electrical Materials and Methods."
- 3.2.2 Create a directory to indicate installed circuit loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Indicate load type (REC, LTG, AHU-1, etc.) and room numbers served for every branch circuit and panelboard served for every circuit breaker.
- 3.2.3 Panelboard Nameplates: Label each panelboard with engraved laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 Connections

- 3.3.1 Ground equipment according to Division 16 Section "Grounding and Bonding."
- 3.3.2 Connect wiring according to Division 16 Section "Conductors and Cables."

3.4 Cleaning

- 3.4.1 On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

SECTION 16510/OCCUPANCY SENSORS1 GENERAL1.1 Related Documents

1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

1.2.1 This Section includes occupancy sensors for lighting control.

1.3 Definitions

1.3.1 DT: Dual Technology

1.3.2 LED: Light-emitting diode.

1.3.3 PIR: Passive infrared.

1.4 Quality Assurance

1.4.1 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4.2 All products shall be UL listed.

1.5 Coordination

1.5.1 Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.6 Approval Submittals:

1.6.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of product indicated.

1.6.2 Shop Drawings:

1.6.2.1 Show installation details for occupancy and light-level sensors.

1.6.2.2 1/8" or 1/4" scaled lighting plan showing location, orientation, and coverage area of each sensor.

1.6.2.3 Interconnection diagrams showing field-installed wiring.

- 1.7 Test Reports and Verification Submittals:
 - 1.7.1 Training: Submit letter verifying that Owner training has been received by factory representative.
 - 1.7.2 Perform the following field tests and inspections and prepare test reports:
 - 1.7.2.1 Operational Test: After installing sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements. Verify actuation of each sensor and adjust time delays. Set sensitivities, time delays, etc as required for each specific device based on the actual conditions of the environment in which it exists.
- 1.8 O&M Data Submittals:
 - 1.8.1 Submit manufacturer's maintenance data including parts lists. Include these data, a copy of approval submittals (product data & shop drawings) in O&M manual.
- 2 PRODUCTS
 - 2.1 Manufacturers
 - 2.1.1 In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 2.1.1.1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 2.1.1.1.1 Hubbell Lighting Inc.
 - 2.1.1.1.2 Watt Stopper (The).
 - 2.1.1.1.3 Greengate.
 - 2.1.1.1.4 Crestron.
 - 2.1.2 General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
 - 2.1.2.1 Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 2.1.2.2 Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - 2.1.2.3 Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.

2.1.2.4 Mounting:

2.1.2.4.1 Sensor: Suitable for mounting in any position on a standard outlet box.

2.1.2.4.2 Relay: Externally mounted though a ½-inch knockout in a standard electrical enclosure.

2.1.2.4.3 Time Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

2.1.2.5 Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

2.1.2.6 Bypass Switch: Override the on function in case of sensor failure.

2.1.2.7 Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keeps lighting off when selected lighting level is present.

2.1.3 PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.

2.1.3.1 Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of at least 36 sq. in.

2.1.3.2 Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch high ceiling.

2.1.3.3 Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot high ceiling.

2.1.4 Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.

2.1.4.1 Detector Sensitivity: Detect a person of average size and weight moving at least 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.

2.1.4.2 Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch high ceiling.

2.1.4.3 Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on an 8-foot high ceiling.

2.1.4.4 Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch high ceiling.

2.1.4.5 Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot high ceiling in a corridor not wider than 14 feet.

- 2.1.5 Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.
- 2.1.5.1 Sensitivity Adjustment: Separate for each sensing technology.
- 2.1.5.2 Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of at least 36 sq. in., and detect a person of average size and weight moving at least 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
- 2.1.5.3 Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch high ceiling.
- 2.1.6 Wall Switches: Mount at 48" AFF.
- 2.1.6.1 PIR Type: Single or Dual relay as indicated on plans with override off.
- 2.1.6.2 Digital Time Type: Automatically turns light off after preset time. LCD on front. Audible and visual alert prior to turning lights off.
- 2.2 Conductors and Cables
- 2.2.1 Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying with Division 16 Section "Basic Electrical Materials and Methods."
- 2.2.2 Classes 2 and 3 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 18 AWG, complying with Division 16 Section "Basic Electrical Materials and Methods."
- 2.2.3 Class 1 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 14 AWG, complying with Division 16 Section "Basic Electrical Materials and Methods."
- 2.2.4 Provide plenum rated cable where required.
- 3 EXECUTION
- 3.1 Sensor Installation
- 3.1.1 Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- 3.2 Wiring Installation
- 3.2.1 Wiring Method: Comply with Division 16 Section "Basic Electrical Materials and Methods."
- 3.2.1.1 Minimum conduit size shall be ½ inch.

- 3.2.2 Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- 3.2.3 Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.
- 3.2.4 Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- 3.2.5 Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- 3.2.6 Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- 3.3 Identification
- 3.3.1 Identify components and power and control wiring according to Division 16 Section "Basic Electrical Materials and Methods."
- 3.4 Adjusting
- 3.4.1 Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

END OF SECTION

SECTION 16520/INTERIOR LIGHTING1 GENERAL1.1 Related Documents

1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

1.2.1 This Section includes the following:

1.2.1.1 Interior lighting fixtures with lamps and ballasts.

1.2.1.2 Lighting fixtures mounted on exterior building surfaces.

1.3 Quality Assurance

1.3.1 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.3.2 Comply with NFPA 70.

1.3.3 NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.4 Coordination

1.4.1 Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.5 Approval Submittals:

1.5.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of lighting fixture scheduled.

1.5.1.1 Arrange data in the order as they appear in the Lighting Fixture Schedule.

1.5.1.2 Include with each light fixture product data the ballast and lamp product data for that particular fixture. This information must accompany the light fixture product data.

1.6 Test Reports and Verification Submittals:

1.6.1 Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal. Test every fixture and provide written documentation of results.

1.7 O&M Data Submittals:

- 1.7.1 Submit manufacturer's maintenance data including parts lists. Include these data, a copy of approval submittals (product data & shop drawings) in O&M manual.

2 PRODUCTS

2.1 Manufacturers

- 2.1.1 In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

- 2.1.1.1 Products: Subject to compliance with requirements, products that may be incorporated into the Work include the products specified.

2.2 Fixtures and Components, General

- 2.2.1 Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

- 2.2.2 Fluorescent Fixtures: Comply with UL 1570.

- 2.2.3 Metal Parts: Free of burrs and sharp corners and edges.

- 2.2.4 Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

- 2.2.5 Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

- 2.2.6 Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

- 2.2.6.1 White Surfaces: 85 percent.

- 2.2.6.2 Specular Surfaces: 83 percent.

- 2.2.6.3 Diffusing Specular Surfaces: 75 percent.

- 2.2.6.4 Laminated Silver Metallized Film: 90 percent.

2.2.7 Plastic Diffusers, Covers, and Globes:

- 2.2.7.1 Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

- 2.2.7.1.1 Lens Thickness: At least 0.156 inch (3.175 mm) minimum unless different thickness is scheduled.

2.2.7.1.2 UV stabilized.

2.3 Lighting Fixtures

2.3.1 Fixtures shall be as indicated in the Lighting Fixture Schedule.

2.4 Fluorescent Lamp Ballasts

2.4.1 Ballasts for Low-Temperature Environments: Fluorescent ballast having a minimum starting temperature of zero degrees F in fixtures mounted in outdoors, in unheated buildings, and as indicated.

2.4.2 Programmed Start Solid State Electronic Ballasts: Electronic ballasts shall include the following features, unless otherwise indicated:

2.4.2.1 The electronic ballast shall be physically interchangeable with standard electromagnetic ballasts and standard electronic ballasts.

2.4.2.2 The electronic ballast shall have a maximum height of 1.18 in. and maximum weight of 1.8 lbs.

2.4.2.3 The electronic ballast shall be furnished with integral leads, color-coded to ANSI C82.11.

2.4.2.4 The electronic ballast shall operate from a nominal line voltage of 120 or 277 volts, +/-10%, 60Hz.

2.4.2.5 The electronic ballast input current shall have Total Harmonic Distortion (THD) of less than 10% when used with primary lamp.

2.4.2.6 The electronic ballast shall have a Power Factor greater than 98% when used with primary lamp.

2.4.2.7 The electronic ballast shall withstand a sustained short to ground or open circuit of any output leads.

2.4.2.8 The electronic ballast shall be Sound Rated A.

2.4.2.9 The electronic ballast shall be specifically designed for use with the specified lamps.

2.4.2.10 The electronic ballast output frequency to the lamps shall be above 40kHz to minimize interference with infrared control systems and eliminate visible flicker.

2.4.2.11 The electronic ballast shall meet ANSI C82.11, where applicable.

2.4.2.12 The electronic ballast shall withstand transients specified in ANSI C62.41, Location Category A3.

2.4.2.13 The electronic ballast shall be CBM certified, where applicable.

2.4.2.14 The electronic ballast shall meet the requirements of the Federal Communications Commission rules and regulations, Title 47 CFR part 18, for Non-Consumer equipment.

- 2.4.2.15 The electronic ballast shall comply with all applicable state and federal efficiency standards.
- 2.4.2.16 The electronic ballast shall be Underwriters Laboratories (UL) Listed (Class P) and CSA Certified where applicable.
- 2.4.2.17 The electronic ballast shall not contain Polychlorinated Biphenyl (PCB's).
- 2.4.2.18 The electronic ballast shall carry a five-year warranty from the date of manufacture. Warranty shall be valid for a maximum case temperature of 70°C.
- 2.4.2.19 The manufacturer shall have a ten-year history of producing electronic ballast for the North American market.
- 2.4.2.20 The electronic ballast shall be produced in a factory certified to ISO 9002 Quality System Standards.
- 2.4.2.21 Ballast shall be produced in the United States of America.
- 2.4.2.22 Ballast shall have a minimum starting temperature of 0°F.
- 2.4.2.23 Approved Manufacturer: Universal Accustart, Phillips Advance Optanium series, G.E. Ultra Start.

2.5 Fluorescent Emergency Lighting Fixtures

- 2.5.1 Internal Type: Self-contained, modular, battery-inverter unit factory mounted within fixture body. Comply with UL 924.
 - 2.5.1.1 Emergency Connection: Operate one or more fluorescent lamps continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 - 2.5.1.2 Test Switch and Light-Emitting-Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - 2.5.1.3 Battery: Sealed, maintenance-free, nickel-cadmium type with minimum seven-year nominal life.
 - 2.5.1.4 Charger: Fully automatic, solid-state, constant-current type.
 - 2.5.1.5 1400 lumen output for a minimum of 90 minutes depending upon lamp type and quantity.
 - 2.5.1.6 Approved manufacturers are Bodine, Beghell and Emergi-lite.
 - 2.5.1.7 In exterior locations, provide equipment capable of operating at temperatures from 0°F to 130°F.

2.6 Fluorescent Lamps:

- 2.6.1 T8 Fluorescent: Provide the number, type, and wattage indicated. Lamps shall be rapid start, low mercury, rated 32 watts, 2950 approximate initial lumens, 24,000 hours average rated life, 85 CRI, 4100k color temp. Average rated life is based on 3 hours operating per start. Lamps shall be General Electric, Sylvania, Philips.

2.6.2 Compact Fluorescent: Provide the number, type, and wattage indicated. Lamps shall be rated, 10,000 hours average rated life, 85 CRI, 4100k color temp. Average rated life is based on 3 hours operating per start. Lamps shall be General Electric, Sylvania, Philips.

2.7 Fixture Support Components

2.7.1 Comply with Division 16 Section "Basic Electrical Materials and Methods" for channel- and angle-iron supports and nonmetallic channel and angle supports.

2.7.2 Single-Stem Hangers: ½-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

2.7.3 Twin-Stem Hangers: Two, ½-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

2.7.4 Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gage (2.68 mm).

2.7.5 Wires For Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

2.7.6 Rod Hangers: 3/16-inch- (5-mm-) minimum diameter, cadmium-plated, threaded steel rod.

2.8 Finishes

2.8.1 Fixtures: Manufacturers' standard, unless otherwise indicated.

2.8.1.1 Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.

2.8.1.2 Metallic Finish: Corrosion resistant.

3 EXECUTION

3.1 Installation

3.1.1 Fixtures: Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved drawings. The installation shall meet with the requirements of NFPA 70. Mounting heights specified or indicated shall be to bottom of fixture for ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures. Obtain approval of the exact mounting for lighting fixtures on the job before installation is commenced and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed. 1' x 4', 2' x 4' and 2' x 2' recessed and semi-recessed fixtures may be supported from suspended ceiling support system ceiling tees if the ceiling system support wires are provided at a minimum of four wires per fixture and located not more than 6 inches from each corner of the fixture. Additionally, for recessed fixtures, provide support clips securely fastened to ceiling grid members, a minimum of one at or near each corner of each fixture. For round fixtures or fixtures smaller in size than the ceiling grid, provide a minimum of two wires per fixture and locate at opposite corners of the ceiling grid in which the fixture is located. Do not support fixtures by ceiling acoustical panels. Where fixtures of sizes less than the ceiling grid are indicated to be centered in the acoustical panel, support such fixtures

independently or with at least two 3/4-inch metal channels spanning, and secured to the ceiling tees. Provide wires for lighting fixture support in this section. There are many type of ceiling systems available on the market and any number of these ceiling systems may be used as part of this work. Verify the types of ceiling construction before ordering fixture fabrication. Determine that suspension methods and flange arrangements for fixtures coordinate with ceiling types and their suspension systems.

3.1.2 Adjust aimable fixtures to provide required light intensities.

3.2 Connections

3.2.1 Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 Field Quality Control

3.3.1 Inspect each installed fixture for damage. Replace damaged fixtures and components.

3.3.2 Verify normal operation of each fixture after installation.

3.3.3 Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

3.3.4 Clean all fixtures. Wipe down and remove finger prints, dust, dirt, grime, etc.

3.3.5 Lamp "Burn-in": All lamps, at initial energization, shall be "burned-in" at 100% output for a minimum of 100 hours.

END OF SECTION

SECTION 16900/WORK REQUIRED FOR EQUIPMENT FURNISHED BY OTHER DIVISIONS1 GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.1.2 Division-16 Basic Electrical Materials and Methods Sections apply to work of this Section.
- 1.1.3 Review all project drawings to be aware of conditions affecting work herein.

2 PRODUCTS

- 2.1 Materials for this section are specified in the Section "Basic Materials and Methods."

3 EXECUTION

- 3.1 Provide raceway boxes, fittings, devices and conductors for the electrical power to equipment furnished and installed in the other Divisions.
- 3.2 Make connections for the electrical power to equipment furnished and installed in other Divisions.
- 3.3 Verify voltage, phase, and current requirements for all equipment being supplied by other divisions. Any modifications shall be incorporated into the electrical submittals with references to any modification and reason. The electrical system is designed around the specified equipment. Any change in the equipment shall be coordinated so that proper electrical protection is obtained. In addition, if the supplied equipment has higher minimum circuit ampacity than the equipment specified, the contractor shall call the modification to the Engineer's attention and make necessary conduit, wire, circuit breaker and equipment changes to accommodate the higher ampacity requirements.
- 3.4 Any change from the specified equipment requirements shall be the responsibility of the contractor.
- 3.5 The electrical contractor shall meet with the Division 15 contractor and fully coordinate locations of mechanical equipment, duct work and piping to ensure that proper working clearance as required in the NEC is obtained. Any conflict shall be reported to the Engineer in writing prior to the installation of any of the equipment. Refer to additional requirements for planning drawings.
- 3.6 Coordinate exact locations and electrical rough-in requirements with other Divisions prior to installation to ensure proper clearances and code requirements are met.

END OF SECTION