

# LAN

LAN ASSOCIATES

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**CONTRACT DOCUMENTS  
AND  
TECHNICAL SPECIFICATIONS  
FOR  
NEW MAINTENANCE BUILDING  
AT  
825 WEST LAKE DRIVE  
THORNWOOD, NY 10594  
NYSED #66-08-01-06-3-012-001**

Mount Pleasant Central School District  
825 West Lake Drive  
Thornwood, NY 10594

Telephone No. 914-769-5500

Contact: Dr. Peter Giarrizzo,  
Superintendent of Schools

**LAN Job #4.1449.02**  
NYSED Submission: July 8, 2021  
Issue to Bid: January 25, 2022



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Contact: Dr. Peter Giarrizzo,  
Superintendent of Schools

I, Michael J. McGovern, RA certify that to the best of my knowledge, information, and belief, the drawings and specifications are in accordance with applicable requirements of the International Building Code and Building Standards of the New York State Education Department.

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Michael J. McGovern, RA  
NY RA #022257

**LAN Job #4.1449.02**  
NYSED Submission: July 8, 2021  
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SINCE 1965

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## TABLE OF CONTENTS

<u>DIVISION NO.</u>	<u>TITLE</u>	<u>PAGE NO.</u>
0	GENERAL DOCUMENTS	
	Cover	
	Soft Cover (Seal & Signature of A/E).....	A/E-1
	Table of Contents.....	TOC-1
DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS		
00 01 15	List of Drawings.....	000115-1
00 10 00	Notice to Bidders.....	001000-1
00 21 00	Instructions to Bidders .....	002100-1
00 40 00	Sexual Harassment Prevention Certification Form.....	004000-1
00 41 01	Forms to Be Submitted with Bid.....	004101-1
00 41 02	Bid Proposal Form .....	004102-1
00 41 16	Bid Forms.....	004100-1
00 43 90	Surety's Consent.....	004390-1
00 43 91	Certificate of Bidder.....	004391-1
00 43 92	Qualifications of Bidders .....	004392-1
00 43 93	Statement of Bidders Qualifications.....	004393-1
00 43 94	Bidder's Personnel.....	004394-1
00 43 95	Conflict of Interest Certificate.....	004395-1
00 43 96	Form of Disclosure Certificate.....	004396-1
00 43 97	Non-Collusion Affidavit.....	004397-1
00 43 98	Certification of Compliance with the Iran Divestment Act.....	004398-1
00 43 99	Declaration of Bidder's Inability to Provide Certification of Compliance with the Iran Divestment Act.....	004399-1
00 45 03	Insurance Certification Form.....	004503-1
00 45 21	Hold Harmless Agreement.....	004521-1
00 46 43	Wage and Hour Rates .....	004643-1
00 50 00	Owner Contractor Agreement .....	005000-1
00 61 00	Bond Requirements .....	006100-1
00 61 01	Bid Bond Form AIA 310-2010.....	006101-1
00 61 02	Performance Bond Form AIA 312-2010.....	006102-1
00 61 03	Payment Bond Form AIA 312-2010.....	006103-1
00 63 00	Request for Information .....	006300-1
00 63 01	RFI Form AIA G716-2004 .....	006301-1
00 70 00	General Conditions of the Contract for Construction .....	007000-1
00 70 01	Partial Waiver of Liens .....	007001-1
00 70 02	Certified Payroll.....	007002-1
DIVISION 1 - GENERAL REQUIREMENTS		
01 10 00	Summary of Work .....	011000-1
01 11 00	Milestone Schedule.....	011100-1
01 21 00	Allowances .....	012100-1
01 22 00	Unit Prices.....	012200-1
01 23 00	Alternates.....	012300-1
01 25 00	Substitution Procedures.....	012500-1
01 26 00	Contract Modification Procedures.....	012600-1
01 29 00	Payment Procedures.....	012900-1

<u>DIVISION NO.</u>	<u>TITLE</u>	<u>PAGE NO.</u>
DIVISION 1 - GENERAL REQUIREMENTS (continued)		
01 31 00	Project Management and Coordination .....	013100-1
01 31 50	COVID-19 Contractor Procedures .....	013150-1
01 32 16	Construction Progress Schedule .....	013216-1
01 32 33	Photographic Documentation.....	013233-1
01 33 00	Submittal Procedures.....	013300-1
01 40 00	Quality Requirements.....	014000-1
01 45 33	Code-Required Special Inspections.....	014533-1
01 50 00	Temporary Facilities and Controls .....	015000-1
01 51 10	SED Commissioners Regulations.....	015110-1
01 60 00	Product Requirements .....	016000-1
01 73 00	Execution Requirements .....	017300-1
01 74 19	Construction Waste Management and Disposal.....	017419-1
01 74 23	Cleaning Up .....	017423-1
01 77 00	Closeout Procedures.....	017700-1
01 77 01	Closeout Checklist .....	017701-1
01 78 23	Operation and Maintenance Data .....	017823-1
01 78 39	Project Record Documents .....	017839-1
01 91 13	General Commissioning Requirements .....	019113-1
DIVISION 3 – CONCRETE		
03 30 00	Cast-in-Place Concrete .....	033000-1
03 54 00	Concrete Underlayment Patch .....	035400-1
03 54 16	Cement-Based, Interior, Self-Leveling Underlayment .....	035416-1
DIVISION 5 – METALS		
05 40 00	Cold Formed Steel Framing.....	054000-1
DIVISION 6 – WOOD AND PLASTICS		
06 10 00	Rough Carpentry.....	061000-1
06 61 16	Solid Surfacing Fabrications .....	066116-1
DIVISION 7 – THERMAL AND MOISTURE PROTECTION		
07 21 00	Building Insulation.....	072100-1
07 84 43	Firestopping .....	078443-1
07 92 00	Joint Sealants.....	079200-1
DIVISION 8 – OPENINGS		
08 11 13	Hollow Metal Doors and Frames.....	081113-1
08 31 13	Access Doors and Frames.....	083113-1
08 36 00	Sectional Overhead Doors .....	083600-1
08 51 13	Aluminum Windows.....	085113-1
08 71 00	Door Hardware .....	087100-1
08 81 00	Glass and Glazing.....	088100-1
08 90 00	Louvers and Vents .....	089000-1

<u>DIVISION NO.</u>	<u>TITLE</u>	<u>PAGE NO.</u>
DIVISION 9 – FINISHES		
09 05 61	Water Vapor Emission Control System for Concrete Slabs.....	090561-1
09 29 00	Gypsum Board .....	092900-1
09 51 13	Acoustic Tile Ceilings .....	095113-1
09 65 13	Resilient Base and Accessories.....	096513-1
09 67 23	Resinous Flooring.....	096723-1
09 91 23	Interior Painting .....	099123-1
DIVISION 12 – FURNISHINGS		
12 35 54	Manufactured Casework .....	123554-1
DIVISION 13 – METAL BUILDING SYSTEMS		
13 34 19	Metal Building Systems.....	133419-1
DIVISION 22 – PLUMBING		
22 00 00	Plumbing Summary of Work .....	220000-1
22 05 01	Basic Plumbing Materials and Methods.....	220501-1
22 05 17	Sleeves and Sleeve Seals for Plumbing Piping.....	220517-1
22 05 18	Escutcheons for Plumbing Piping.....	220518-1
22 05 19	Meters and Gages for Plumbing Piping .....	220519-1
22 05 23	Valves .....	220523-1
22 05 29	Hangers and Supports for Plumbing and Piping Equipment .....	220529-1
22 05 48	Vibration Controls.....	220548-1
22 05 53	Identification for Plumbing Piping and Equipment .....	220553-1
22 07 19	Plumbing Piping Insulation.....	220719-1
22 11 16	Domestic Water Piping .....	221116-1
22 11 19	Domestic Water Piping Specialties .....	221119-1
22 13 16	Sanitary Waste and Vent Piping .....	221316-1
22 13 19	Sanitary Waste Piping Specialties .....	221319-1
22 33 00	Electric Domestic-Water Heaters.....	223300-1
22 41 00	Plumbing Fixtures .....	224213-1
22 42 13	Commercial Water Closets .....	224213-1
DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING		
23 00 00	Mechanical Summary of Work .....	230000-1
23 05 00	Common Work Results for HVAC.....	230500-1
23 05 13	Common Motor Requirements for HVAC Equipment .....	230513-1
23 05 29	Hangers and Supports for HVAC Piping and Equipment .....	230529-1
23 05 53	Mechanical Identification.....	230553-1
23 05 93	Testing, Adjusting, and Balancing for HVAC .....	230593-1
23 07 19	Piping Insulation.....	230719-1
23 09 93	Sequence of Operations for HVAC Controls .....	230993-1
23 23 00	Refrigerant Piping .....	232300-1
23 31 13	Metal Ducts .....	233113-1
23 33 00	Air Duct Accessories .....	233300-1
23 34 16	Centrifugal HVAC Fans.....	233416-1
23 37 13	Diffusers, Registers and Grilles .....	233713-1
23 81 26	Split-System Air – Conditioners .....	238126-1
Mount Pleasant CSD/ New Maintenance Building NYSED #66-08-01-06-3-012-001	TOC-3	#4.1449.02

23 82 36	Finned-Tube Radiation Heaters .....	238236-1
DIVISION		PAGE
<u>NO.</u>	<u>TITLE</u>	<u>NO.</u>

#### DIVISION 26 – ELECTRICAL

26 05 00	Common Work Results for Electrical .....	260500-1
26 05 19	Low-Voltage Electrical Power Conductors and Cables .....	260519-1
26 05 23	Control-Voltage Electrical Power Cables .....	260523-1
26 05 26	Grounding and Bonding for Electrical Systems .....	260526-1
26 05 29	Hangers and Supports for Electrical Systems .....	260529-1
26 05 32	Interior Raceways Fittings and Accessories .....	260532-1
26 05 33	Raceway and Boxes for Electrical Systems .....	260533-1
26 05 43	Underground Ducts and Raceways for Electrical Systems .....	260543-1
26 05 44	Sleeves and Sleeve Seals for Electrical Raceways and Cabling .....	260544-1
26 05 48	Seismic Controls for Electrical Systems .....	260548-1
26 05 53	Electrical Identification .....	260553-1
26 05 63	Equipment Connections and Coordination .....	260563-1
26 08 00	Electrical Systems Commissioning .....	260800-1
26 24 13	Switchboards .....	262413-1
26 24 16	Panelboards .....	262416-1
26 27 26	Wiring Devices .....	262726-1
26 28 12	Safety Switches .....	262812-1
26 28 13	Fuses .....	262813-1
26 28 16	Enclosed Switches and Circuit Breakers .....	262816-1
26 51 00	Lighting .....	265100-1
26 51 19	LED Interior Lighting .....	265119-1
26 56 00	Exterior Lighting .....	265600-1

#### DIVISION 27 – COMMUNICATIONS

27 00 00	Communication .....	270000-1
27 05 00	Common Work Results for Communications .....	270500-1
27 05 26	Grounding and Bonding for Communications .....	270526-1
27 05 28	Pathways for Communications Systems .....	270528-1
27 10 00	Structured Cabling .....	271000-1
27 11 00	Communications Equipment Room Fittings .....	271100-1
27 11 10	Network Equipment .....	271110-1
27 13 00	Communications Backbone Cabling .....	271300-1
27 14 00	Fiber Optic Cable and Equipment .....	271400-1
27 15 00	Communications Horizontal Cabling .....	271500-1
27 20 00	Data Communications .....	272000-1
27 21 00	Data Communications Network Equipment .....	272100-1
27 21 02	Data Systems .....	272102-1
27 66 00	Communications Equipment Rooms and Fittings .....	276600-1

#### DIVISION 31 - EARTHWORK

31 10 00	Site Clearing .....	311000-1
31 20 01	Earthwork .....	312001-1
31 23 18	Site Trenching .....	312318-1
31 23 19	Dewatering .....	312319-1
31 31 17	Soil Conservation .....	313117-1
31 50 00	Excavation Support & Protection .....	315000-1

<u>DIVISION NO.</u>	<u>TITLE</u>	<u>PAGE NO.</u>
DIVISION 32 – EXTERIOR IMPROVEMENTS		
32 13 13	Bituminous Concrete Paving.....	321313-1
32 16 13	Concrete Curbing .....	321613-1
32 16 14	Concrete Site Work .....	321614-1
32 17 23	Pavement Markings .....	321723-1
32 92 00	Lawns and Grasses .....	329200-1
32 93 00	Landscaping.....	329300-1
DIVISION 33 – UTILITIES		
33 05 00	Common Work Results for Utilities .....	330500-1
33 11 16	Site Water Utility Distribution Piping .....	331116-1
33 31 00	Sanitary Utility Sewerage Piping.....	333100-1
33 39 00	Sanitary Utility Sewerage Structures .....	333900-1
33 41 00	Storm Drainage .....	334100-1
33 46 00	Subdrainage.....	334600-1
33 46 11	Bioretention and Dry Swale Soil .....	334611-1



SECTION 000115 - LIST OF DRAWINGS

1.1 LIST OF DRAWINGS

- A. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

LIST OF DRAWINGS  
(24" x 36" Not Bound in Specifications)

**NEW MAINTENANCE BUILDING**

Mount Pleasant CSD  
825 Westlake Drive  
Thornwood, NY 10594

DRWG.  
NO.

TITLE

T0.01	TITLE SHEET & GENERAL NOTES
SP.11	EXISTING & DEMOLITION SITE PLAN
SP.21	PROPOSED SITE PLAN
CD.01	CONSTRUCTION DETAILS
SC.01	SOIL EROSION & SED. CONTROL PLAN
S2.01	FOUNDATION PLAN
S4.01	SECTIONS
S6.01	GENERAL NOTES AND TYPICAL DETAILS
S6.02	SECTIONS AND TYPICAL DETAILS
CA.01	CODE ANALYSIS
A2.01	PROPOSED FLOOR PLAN
A2.03	PROPOSED ROOF PLAN
A3.01	EXTERIOR ELEVATIONS
A3.02	EXTERIOR ELEVATIONS
A4.01	BUILDING SECTIONS
A5.01	REFLECTED CEILING PLAN
A6.01	DOOR SCHEDULE, TYPES, AND DETAILS
A6.02	DOOR DETAILS
A6.03	WINDOW DETAILS AND WALL TYPES
A7.01	PLAN AND ELEVATORS
M0.01	MECHANICAL GEN. NOTES, LEGEND & ABBREV.
M2.01	PARTIAL PROPOSED 1 <sup>ST</sup> FLOOR MECHANICAL PLAN
M6.01	MECHANICAL SCHEDULES
M6.02	MECHANICAL DETAILS
M6.03	MECHANICAL CONTROLS
E0.01	ELECTRICAL COVER SHEET
E2.01	ELECTRICAL POWER PLAN
E2.02	ELECTRICAL SITE PLANS & DETAILS
E5.01	ELECTRICAL LIGHTING PLAN
P2.01	PROPOSED 1 <sup>ST</sup> FLOOR PLUMBING PLAN
P6.01	RISER DIAGRAMS
P6.02	PLUMBING SCHEDULE & DETAILS

END OF SECTION 000115





## NOTICE TO BIDDERS

MOUNT PLEASANT CENTRAL SCHOOL DISTRICT  
**New Maintenance Building**  
(NYSED #66-08-01-06-3-012-001)

PUBLIC NOTICE is hereby given that sealed bids shall be received by the Board of Education, Mount Pleasant Central School District, 825 Westlake Drive, Thornwood, NY 10594 for the

### **New Maintenance Building**

Bid proposals shall be received by **Tuesday, March 1, 2022** by mail or in person, at the Mount Pleasant Central School District Office, 825 Westlake Drive, Thornwood, NY 10594 until 3:00 P.M. (EST). Please note that the bids will be opened virtually. Staff will be available to accept hand delivered bids between the hours of 9:00 a.m. and 3:00 p.m. on **Tuesday, March 1, 2022**.

**In light of the COVID-19 pandemic, in-person attendance to the bid opening will not be permitted. The bid opening will be recorded and streamed live online. A website address to view the bid opening live will be provided in an addendum to the bid documents.**

All envelopes containing bids shall bear on the face of the sealed envelope the words **"Insert Date", Bid for New Maintenance Building"**. No Bids shall be accepted after **3:00 p.m. on Tuesday, March 1, 2022**. USPS, UPS and FedEx delivery schedules are limited, so please allow enough time for your proposal to arrive on or before the due date and time.

Complete digital sets of Bidding Documents, drawings and specifications, may be obtained online as a download at the following website: [www.revplans.com](http://www.revplans.com) under 'public projects.'

Complete sets of Bidding Documents, Drawings and Specifications, may be obtained from REVplans, 28 Church Street, Unit 7, Warwick, NY 10990 Tel: 1-877-272-0216, upon depositing the sum of \$100 for each combined set of documents beginning on **Tuesday, January 25, 2022**. Checks or money orders shall be made payable to Mount Pleasant Central School District. Plan deposit is refundable in accordance with the terms in the Instructions to Bidders to all submitting bids. Any bidder requiring documents to be shipped shall make arrangements with the printer and pay for all packaging and shipping costs.

Please note REVplans ([www.revplans.com](http://www.revplans.com)) is the designated location and means for distributing and obtaining all bid package information. Only those Contract Documents obtained in this manner will enable a prospective bidder to be identified as an official plan holder of record. The Provider takes no responsibility for the completeness of Contract Documents obtained from other sources. Contract Documents obtained from other sources may not be accurate or may not contain addenda that may have been issued

All bid addenda will be transmitted to registered plan holders via email and will be available at [www.revplans.com](http://www.revplans.com). Plan holders who have paid for hard copies of the bid documents will need to make the determination if hard copies of the addenda are required for their use, and coordinate directly with the printer for hard copies of addenda to be issued. There will be no charge for registered plan holders to obtain hard copies of the bid addenda.

All technical questions, comments, and inquiries should be directed to LAN (Attention Mr. Christopher Carucci, IA at telephone number 845-615-0350, fax number 845-615-0351 or email [christopher.carucci@lanassociates.com](mailto:christopher.carucci@lanassociates.com)).

There will be a **pre-bid conference on Thursday, February 10, 2022 at 3:00 p.m.** at the Mount Pleasant Central School District, High School 825 West Lake Drive, Thornwood, NY 10594. Bidders are urged to attend the pre-bid conference. Knowledge of the project is crucial to obtain a proper understanding of the Work. **A Zoom link will be provided in an addendum to the bid documents.**

Potential bidders may also schedule a site walk through by appointment. Please contact Frank Roberts of Arris Construction Company at 914-755-0930 to schedule a site visit and walkthrough of the building.

**In light of the COVID-19 pandemic, protocols – including sign-in procedures and mandatory wearing of masks – will be in place (those not wearing masks will not be granted access). Bidders will be granted access in small groups to maintain social distancing.**

All laborers, workers and mechanics working on the site of this project must be certified as having successfully completed the OSHA 10-hour construction safety and health course.

No bidder shall withdraw his bid within sixty (60) days after the formal bid opening. The Board of Education reserves the right to waive any informality in any proposals, or to reject any or all proposals and to advertise for new proposals.

Dated:  
By Order of: Board of Education  
Mount Pleasant Central School District  
Thornwood, NY 10594

## SECTION 002100 – INSTRUCTIONS TO BIDDERS

1.0 Opening of Bids: Bids will be opened at the time and place set for in the Advertisement for Bids. Every bid received before that time, or authorized postponement thereof, will be opened and publicly read aloud. Bidders and other persons properly interested may be present in person or by representative.

The Owner may consider informal any bid not prepared and submitted in accordance with the provisions hereof or may waive any informalities in or reject any or all bids. Any bid may be withdrawn prior to the advertised time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered. No bidder may withdraw a bid within sixty (60) days after the actual opening thereof.

Conditional bids will not be accepted.

2.0 Bidding Documents: The bidding documents include the Advertisement for Bids, Instruction to Bidders, Form of Proposal, General Conditions, Supplementary General Conditions, Division 1 - General Requirements, Specifications, Drawings, and all Addenda issued prior to the opening of bids.

3.0 Preparation of Proposal: Proposals must be submitted on prescribed forms or facsimiles thereof. All blank spaces must be filled in, in ink or typewritten, in figures where so indicated.

Note - All contractors, this project is to be bid, the contracts drawn and payments made in such a manner that Sales and Compensating Use Taxes of the State of New York and of cities and counties will not apply to purchases and sales of materials and supplies.

Note - Contractor shall note that whenever brand names or specific product systems are indicated, it shall be clearly understood that such identification is for the purpose of illustrating the type of product and the degree of quality desired. Such identification in no way precludes the contractor from using products of other manufacturers which can be shown in advance to be of like kind and of equal quality under the provisions of New York State Equivalency Clause.

Your attention is directed to Article 11 of the Instructions to Bidders.

All envelopes containing bids shall bear on the face of the sealed envelope the words "New Maintenance Building Project". Each proposal must be submitted in a sealed envelope and shall have clearly designated on the outside the name and address of the bidder, the name of the project, and the contract for which proposal is submitted.

4.0 Non-Collusive Bidding Certificate: Each prime bidder submitting a bid for any portion of the work contemplated by the bidding documents shall execute a non-collusive certificate as required by applicable New York State law, in the form herein provided, to the effect that he has not colluded with any other person, firm, or corporation in regard to any bid submitted. Such certificate shall be attached to the bid. Failure of any bidder to abide by this provision shall be caused for rejection of his bid.

4.5 Each Bid will include a fully executed copy of the "Insurance Certification Form", located in the specification, in their bid packet. Failure to provide may result in the Owner finding the bidder "non-responsive" to the bid documents.

5.0 The Owner shall have the right to take such steps as it deems necessary to determine the ability of the Bidder to perform its obligations under the Contract, and the Bidder shall furnish the Owner all such information and data for this purpose as the Owner may request. The right is reserved to reject any Bid where an investigation of the available evidence or information does not satisfy the Owner that the Bidder is qualified and capable to carry out properly the terms of the Contract. The issuing of Bid Documents and acceptance of the Bidder's payment by the Owner shall not be construed as pre-

qualification of that Bidder. If the Bidder is later discovered to have misrepresented or provided false or incorrect information with regard to any material part of the information submitted to the Owner, including but not limited to information regarding experience, debarment, claims, lawsuits, arbitrations, mediations, finances, license, contract termination, the Owner reserves the right to reject the Bid of such Bidder and, if a construction contract has been awarded, it will become automatically voidable at the sole discretion and election of the Owner.

5.5 To be considered qualified, the Bidder must demonstrate to the Owner's satisfaction the following:

1. The corporation, partnership, sole proprietorship or other business entity in whose name the Bid is submitted has been in business, continuously, for no less than the previous five (5) years performing or coordinating the work which it is bidding on;
2. The Bidder has satisfactorily completed no less than five (5) projects of comparable size, complexity and type to this Project as a prime contractor to project owner;
3. The Bidder is licensed to perform the work it is bidding on in the jurisdiction where the work will take place;
4. The Bidder is capable of and intends to perform at least 25% of the Work with its own forces;
5. The Bidder has sufficient manpower available to it to perform the Work.
6. The Bidder and its subcontractors have a minimum of five (5) years' experience in the Work and applicable trades.

6.0 Bid Security: Each proposal shall be accompanied by a bid bond or certified check. The choice of security to be at the option of the Contractor.

Bid security shall be in amounts as follows:

1. Bid Bond shall be in the amount of 10% of the base bid and shall be on AIA Form A310. It shall be duly executed by the bidder as principal, having as surety thereon a surety company approved by the Owner.
2. Certified checks shall be in the amount of 10% of the base bid.

The aforementioned bid security will be returned to all except the two (2) lowest formal bidders within three (3) days after the formal opening of the proposals. The remaining security will be returned to the two (2) lowest bidders within 48 hours after the Owner and the accepted bidder have executed the contract, or, if no contract has been so executed, within sixty (60) days after the formal bid opening so long as the bidder has not been notified of the acceptance of his proposal.

7.0 Liquidated Damages for Failure to Enter Into Contract: A successful bidder, upon his failure or refusal to execute and deliver the Contract and bonds required within ten (10) days after he has received notice of the acceptance of his proposal, shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with his proposal. Bidder acknowledges that its bid is an offer to contract and that the Owner's award of the contract is acceptance of that offer, thereby created a binding agreement.

8.0 Subcontractors and Material Suppliers: The successful bidder for each Contract shall submit to the Architect/Engineer within ten (10) calendar days after receipt of notification of award of contract, on the form supplied, a list of subcontractors, material suppliers, and manufacturers proposed for the various portions of the work.

9.0 Conditions of Work: Each bidder must inform himself fully of the conditions relating to the construction and labor under which the work is now being or will be performed. Failure to do so will not relieve a successful bidder of his obligations to furnish all material and labor necessary to carry out the provisions of the contract documents and to complete the contemplated work for the consideration set

forth in his bid. The Contractor in the carrying out of his work must employ such methods or means as will not cause any interruption or interference with the work of any other contractor, or the operations of the Owner.

10.0 Obligations of Bidders and Mandatory Site Inspections: At the time of the opening of bids, each bidder will be presumed to have inspected the site, to have familiarized himself with local conditions, and to have read and to be thoroughly familiar with the bidding documents, including all addenda. The failure or omission of any bidder to receive or examine any form, instrument or document shall in no way relieve any bidder from any obligation in respect to his bid.

11.0 Assessments and Taxes:

1. Exemptions from Sales Tax: The Sales and Compensating Use Taxes of the State of New York and the cities and counties do not apply to purchases and sales of materials and supplies pursuant to the provisions of this contract. These taxes are not to be included in the bids. This exception does not, however, apply to tools, machinery, equipment or other property leased by or to the Contractor or a Subcontractor or to materials and supplies of a kind which will not be incorporated into the completed project. (See Supplementary General Conditions, Article 15.)
2. Other Assessments and Taxes: Each bidder shall include in his base bid proposal all other costs and liabilities other than that excluded in the above paragraph for the amounts assessed or taxes upon the wages and salaries paid to employees of the Contractor and his Subcontractors, under the Contractor, or any other taxes assessed by the Federal, State, or Local Government.

12.0 Addenda and Interpretations: No interpretations of the meaning of the drawings, specifications or other contract documents will be made to any bidder orally. Every request for such interpretation shall be in writing addressed to: LAN Associates, Engineering, Planning, Architecture, Surveying, LLP, 252 Main Street, Goshen, NY 10924, Telephone #845-615-0350, Fax #845-615-0351 and to be given consideration must be received at least five (5) days prior to the date fixed for the opening of the bids. Any and all such interpretations and any supplementary instructions will be in the form of written addenda to the specifications or addenda drawings. Addenda will be mailed to all prospective bidders at the respective address furnished for the sending of drawings not later than three (3) days prior to the date as fixed for opening of bids. Failure of any bidder to receive any such addendum or interpretation shall not relieve any bidder from any obligations under this bid as submitted. All addenda so issued shall become part of the contract documents.

13.0 Security for Faithful Performance: The successful bidder shall deliver to the Owner, simultaneously with the executed contract, an executed Performance and Payment bond on AIA Form A312 in quadruplicate, each in the amount of one hundred percent (100%) of the contract amount, as specified hereinafter under the General Conditions. The premium for said bonds shall be included in the Contractor's Base Bid. The surety company or companies shall be acceptable to the Owner and Architect/Engineer and authorized to transact business in New York State.

The current power of attorney for the person who signs for any surety company shall be attached to such bond, indicating the surety or sureties on the bond.

14.0 Method of Award: Award of Contract may be made to the Lowest Qualified Bidder by method as follows:

1. If the award is to be made on the basis of Base Bid only, it may be made to that responsible bidder whose Base Bid therefore is the lowest.

2. If the award is to be made on the basis of the combination of Base Bid with Alternates, it may be made to that responsible bidder whose net bid on such combination is the lowest, using Alternates in any order elected by the Owner.

The Owner reserves the right to reject any and all bids.

15.0 Post-Bid Vetting:

Arris Contracting Co., Inc.  
189 Smith Street  
Poughkeepsie, NY 12601  
845-473-3600

Submissions must be emailed and must include the Project Name of this contract in the subject Line of the Pre-Award submission email.

(1) Pre-award Submittal Package

- (i) Fully executed AIA A305 Contractors Qualification Statement
- (ii) Most recent financial statement certified by CPM
- (iii) References and experience:
  1. List of all past contracts for K-12 School Buildings
  2. Provide references (Name, Title, and Phone Number for Owner , Architect and Construction manager) associated with five (5) different projects of similar scope, size and complexity to the one identified in this contract. Additionally, include the names of two major suppliers used for each of these projects.

(2) Workforce and Work Plan – Provide a detailed written Work Plan which shall demonstrate the contractor's understanding of overall project scope and shall include, but not be limited, to the following:

- (i) Sequential listing of specific project activities required to successfully complete the Work of the contract.
  1. Include Critical Milestones,
  2. Include phasing of the Work, if required.
  3. Include listing of long lead items.
  4. Statement that the project can be completed in established time.
- (ii) Resumes for Contractor's proposed supervisory staff, including qualifications for specialized expertise or any certification(s) required to perform the Work.
- (iii) Names of proposed sub-contractors and a listing of the related trade of work and value.
- (iv) Any special coordination requirements with other trades.
- (v) Any special storage and staging requirements for construction materials.

(3) Detailed Cost Estimate:

- (i) A copy of a Detailed Cost Estimate outlined in CSI format.

16.0 Owner-Contractor Agreement: The form of Contract to be used is as included in the bid specification.

17.0 Final Payment & Maintenance Bond: Upon authorization and certification of the final payment by the Owner, the Owner shall pay the Contractor the amount of said estimate which shall be the balance due the Contractor, including the retained percentage, such sums as may be retained lawfully by the Owner except provided, the nothing herein contained shall be construed to affect the right hereby reserved by the Owner to reject the whole or any portion of the work should the final estimate and

acceptance of such payment by the Contractor, shall release the Owner from all claims and liabilities to the Contractor with his contract.

Prior to authorization of the final payment by the Owner, and prior to the receipt by the Contractor of his final payment, the Contractor shall furnish to the Owner a maintenance bond in the amount of 100% of the total compensation earned by the Contractor in connection with the work. The bond shall be in a form acceptable to the Owner and with a surety company acceptable to the Owner. It shall remain in effect for two years after the date of authorization of the final payment by the Owner.

18.0 Final Payment & Maintenance Bond: Due to the ongoing COVID-19 pandemic and the resulting uncertainty with regard to (a) when the Owner's school(s) will be in session during 2020, (b) what restrictions, if any, will be applicable to construction activities in the Owner's facilities due to State, Federal or Local orders, laws, regulations or rules related to the COVID-19 pandemic (including but not limited to social distancing, cleaning and disinfection requirements) and (c) the duration of any restrictions imposed on construction activities, the Owner may modify the construction schedule set forth in the Contract/Bid Documents.

Any restrictions that will be applicable to construction activities in the Owner's facilities due to State, Federal or Local orders, laws, regulations or rules related to the COVID-19 pandemic (including but not limited to social distancing, cleaning and disinfection requirements) may cause the Owner to have the construction work commence later than the commencement date specified herein.

By submitting a bid, the Bidder acknowledges and agrees that there shall be no additional compensation paid for schedule modifications caused directly or indirectly by the COVID-19 pandemic. The Bidder further acknowledges and agrees that the sole remedy for any schedule modifications or delays caused directly or indirectly by the COVID-19 pandemic shall be an extension of time, if warranted.

END OF SECTION 002100





### Sexual Harassment Prevention Certification Form

By submission of this bid, the person signing on behalf of the bidder certifies, under penalty of perjury, that: the bidder has and has implemented a written policy addressing sexual harassment prevention in the workplace; the bidder provides annual sexual harassment prevention training to all of its employees; and that the principal(s) and all employees of the bidder have completed the sexual harassment prevention training in the last twelve (12) months. Such policy shall, at a minimum, meet the requirements of Section 201-g of the Labor Law.

Bidder Name: \_\_\_\_\_

Bidder Address: \_\_\_\_\_

Print Name and Title: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Sworn to before me this \_\_\_\_\_

day of \_\_\_\_\_, 20\_\_\_\_

\_\_\_\_\_  
Notary Public



Section  
No.

FORMS TO BE SUBMITTED WITH BID  
(Submit All Forms With Bid In The Order They Are Listed Below)

004000	Sexual Harassment Prevention Certification Form	<input type="checkbox"/>
004102	Bid Proposal	<input type="checkbox"/>
004116	Bid Forms	<input type="checkbox"/>
004390	Surety's Consent	<input type="checkbox"/>
004391	Certificate of Bidder	<input type="checkbox"/>
004393	Statement of Bidders Qualifications	<input type="checkbox"/>
004394	Bidder's Personnel	<input type="checkbox"/>
004395	Conflict of Interest Certificate	<input type="checkbox"/>
004396	Form of Disclosure Certificate	<input type="checkbox"/>
004397	Non-Collusion Affidavit	<input type="checkbox"/>
004398	Certification of Compliance with the Iran Divestment Act	<input type="checkbox"/>
004399	Declaration of Bidder's Inability to Provide Certification of Compliance with the Iran Divestment Act	<input type="checkbox"/>
004503	Insurance Certification Form	<input type="checkbox"/>
004521	Hold Harmless Agreement	<input type="checkbox"/>
006101	Bid Bond	<input type="checkbox"/>
007316	Insurance Requirements	<input type="checkbox"/>

**NOTES:**

1. CONTRACTOR MUST SUPPLY A STREET ADDRESS. POST OFFICE BOX NUMBER IS NOT ACCEPTABLE.
2. ALL PROPOSAL FORMS, CONTRACT DOCUMENTS, ETC. MUST BE COMPLETED AND SIGNED IN BLACK INK ONLY.
3. PLEASE PRINT THE NAME OF ALL SIGNATORY PARTIES UNDER THE SIGNATURE: SPELL OUT NAME IN FULL.
4. AFFIRMATIVE ACTION PROGRAM DOCUMENTATION CAN BE REVIEWED DURING REGULAR BUSINESS HOURS AT MOUNT PLEASANT CENTRAL SCHOOL DISTRICT, THORNWOOD, NEW YORK.
5. WAGE RATE DOCUMENTATION CAN BE REVIEWED DURING REGULAR BUSINESS HOURS AT MOUNT PLEASANT CENTRAL SCHOOL DISTRICT, THORNWOOD, NEW YORK.



BID PROPOSAL

MOUNT PLEASANT CENTRAL SCHOOL DISTRICT

FOR THE **NEW MAINTENANCE BUILDING**

Made this \_\_\_\_\_ Day of \_\_\_\_\_, \_\_\_\_\_

\_\_\_\_\_  
(Corporation, Individual, or Partnership)

\_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_

The party above named, as bidder, declares that the only person or persons interested in this bid or proposal as principal or principals is or are named above, and that no person that hereinbefore named as any interest in this proposal or in the contract proposed to be taken; that this bid or proposal is not made with any person or persons making a bid or proposal for the same purpose; and that no officer or employee of the Mount Pleasant Central School District, is or shall be, or will become, directly or indirectly interested as a contracting party, partner, stockholder, surety or otherwise in the performance of the contract, or in the supplies, work, that business to which it relates, or any portion of the profits thereof; that he has examined the site of the work, that he has examined the Contract Documents and the drawings therein referred to and has read the "Information to Bidders" hereto attached; and he proposes and agrees that this Proposal be accepted, that he will contract in the form provided for the **NEW MAINTENANCE BUILDING** to furnish all necessary labor, material, plant, power tools, equipment, supplies, and transportation, and perform all work mentioned in the contract documents for the following lump sum base bid price, alternates, and unit prices:

(SEE FOLLOWING PAGES AND FILL IN ALL INFORMATION REQUIRED.)



SECTION 004116 - BID FORM  
MOUNT PLEASANT CSD  
New Maintenance Building  
Contract #1 - General Construction  
State Plan #66-08-01-06-3-012-001

<b>BUSINESS NAME:</b>	
<b>ADDRESS:</b>	
<b>TELEPHONE NO.:</b>	
<b>FAX NO.:</b>	
<b>CONTRACT #1 (GC): Base Bid</b>	<b>\$ (SubTotal)</b>
<b>CONTRACT #1 (GC-1): Allowance</b>	<b>\$30,000.00</b>
<b>CONTRACT #1 (GC-2): Allowance - Rock Removal</b>	<b>\$</b>
<b>CONTRACT #1 (GC-3): Allowance - Unsuitable Soil</b>	<b>\$</b>
<b>CONTRACT #1 (GC): Combined Base Bid (Sum)</b>	<b>\$ (Total)</b>
<b><u>ALTERNATES:</u></b> The following amounts proposed for identified work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner chooses 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. Specification Section 012300 for Alternate descriptions.	
Add Alternate # 1-1	+ \$
<b><u>UNIT PRICES:</u></b> Should the contract work be increased or decreased as per the General Conditions of the Contract, Article 8, Changes in the Work, the bidder hereby agrees that the following unit price is the basis for the extra or the credit. The price includes all labor, material, overhead, profit, administration, insurance, applicable taxes, and incidental or contributory items, or cost to the contractor and/or suppliers in connection therewith. The undersigned agrees to the following prices stipulated below as the amount of extra or credit to be applied to the contract for the increase or decrease in the scope of work if required during the course of the project. Refer to Specification Section 012200 for Unit Price descriptions.	
Unit Price GC#1- Rock Removal	\$ /CY
Unit Price GC#2 - Replacement of Unsuitable Backfill Material	\$ /CY
<b>Acknowledgement by Bidder – Receipt of Addendum (please initial all boxes to verify)</b>	
<b>No.1</b> <b>No.2</b> <b>No.3</b> <b>No.4</b> <b>No.5</b> <b>No.6</b> <b>No.7</b> <b>No.8</b>	
<b>REFER TO PAGE SECTION 004101 FOR A COMPLETE LIST OF FORMS TO BE SUBMITTED WITH THE BID.</b>	
<b><u>NOTES:</u></b> 1). Method of Award: Award of Contract may be made to the Lowest Responsible Bidder by method as follows: •If the award is to be made on the basis of Base Bid only, it may be made to that responsible bidder whose Base Bid therefor is the lowest and responsive to the bid specifications. •If the award is to be made on the basis of the combination of Base Bid with Alternates, it may be made to that responsible bidder whose net bid on such combination is the lowest, using Alternates in any order elected by the Owner.  The District reserves the right to award a contract to the lowest responsible bidder providing the required security within forty-five (45) days of the date opening of the bids. Bidders may not withdraw their respective bids for a period of forty-five (45) days after the bid opening date, unless otherwise authorized by law. To the fullest extent allowed by law, the District further reserves the right to award the contract with or without alternates, using alternates in any order elected by the owner, whichever is deemed to be in the best interests of the District.  The District further reserves the right to reject bids that contain conditions, omissions, exceptions or modifications, or in its sole discretion to waive any irregularities in the bids, or to reject any or all bids or to accept any bid which in the opinion of the District is in its best interest.  2). On acceptance of the bid for the work, the undersigned hereby binds himself/herself/themselves to enter into a written contract with the Board of Education within ten (10) days of the notice of award, and to comply in all respects with the requirements and provisions set forth in the Bid Specifications, including but not limited to the Bid Instructions and the General Conditions in relation to security for the faithful performance of the terms of said contract.	
<b>Signature:</b>	
<b>Printed Name of Person Signing:</b>	
<b>Title of Person Signing:</b>	





SECTION 004116 - BID FORM  
MOUNT PLEASANT CSD  
New Maintenance Building  
Contract #2 - Mechanical Construction  
State Plan #66-08-01-06-3-012-001

<b>BUSINESS NAME:</b>	
<b>ADDRESS:</b>	
<b>TELEPHONE NO.:</b>	
<b>FAX NO.:</b>	
<b>CONTRACT #2 (MC): Base Bid</b>	<b>\$ (SubTotal)</b>
<b>CONTRACT #2 (MC-1): Allowance</b>	<b>\$20,000.00</b>
<b>CONTRACT #2 (MC): Combined Base Bid (Sum)</b>	<b>\$ (Total)</b>
<b>ALTERNATES:</b>	
<i>The following amounts proposed for identified work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner chooses 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. Specification Section 012300 for Alternate descriptions.</i>	
Add Alternate # 2-1	+\$
<b>Acknowledgement by Bidder – Receipt of Addendum (please initial all boxes to verify)</b>	
No.1	No.2
No.3	No.4
No.5	No.6
No.7	No.8
<b>REFER TO PAGE SECTION 004101 FOR A COMPLETE LIST OF FORMS TO BE SUBMITTED WITH THE BID.</b>	
<b>NOTES:</b>	
1). Method of Award: Award of Contract may be made to the Lowest Responsible Bidder by method as follows: •If the award is to be made on the basis of Base Bid only, it may be made to that responsible bidder whose Base Bid therefor is the lowest and responsive to the bid specifications. •If the award is to be made on the basis of the combination of Base Bid with Alternates, it may be made to that responsible bidder whose net bid on such combination is the lowest, using Alternates in any order elected by the Owner.  <i>The District reserves the right to award a contract to the lowest responsible bidder providing the required security within forty-five (45) days of the date opening of the bids. Bidders may not withdraw their respective bids for a period of forty-five (45) days after the bid opening date, unless otherwise authorized by law. To the fullest extent allowed by law, the District further reserves the right to award the contract with or without alternates, using alternates in any order elected by the owner, whichever is deemed to be in the best interests of the District.</i>  <i>The District further reserves the right to reject bids that contain conditions, omissions, exceptions or modifications, or in its sole discretion to waive any irregularities in the bids, or to reject any or all bids or to accept any bid which in the opinion of the District is in its best interest.</i>  2). On acceptance of the bid for the work, the undersigned hereby binds himself/herself/themselves to enter into a written contract with the Board of Education within ten (10) days of the notice of award, and to comply in all respects with the requirements and provisions set forth in the Bid Specifications, including but not limited to the Bid Instructions and the General Conditions in relation to security for the faithful performance of the terms of said contract.	
<b>Signature:</b>	
<b>Printed Name of Person Signing:</b>	
<b>Title of Person Signing:</b>	



SECTION 004116 - BID FORM  
MOUNT PLEASANT CSD  
New Maintenance Building  
Contract #3 - Electrical Construction  
State Plan #66-08-01-06-3-012-001

<b>BUSINESS NAME:</b>	
<b>ADDRESS:</b>	
<b>TELEPHONE NO.:</b>	
<b>FAX NO.:</b>	
<b>CONTRACT #3 (EC): Base Bid</b>	<b>\$ (SubTotal)</b>
<b>CONTRACT #3 (EC-1): Allowance</b>	<b>\$10,000.00</b>
<b>CONTRACT #3 (EC-2): Allowance - Rock Removal</b>	<b>\$</b>
<b>CONTRACT #3 (EC-3): Allowance - Unsuitable Soil</b>	<b>\$</b>
<b>CONTRACT #3 (EC): Combined Base Bid (Sum)</b>	<b>\$ (Total)</b>
<b>ALTERNATES:</b>	
The following amounts proposed for identified work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner chooses 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. Specification Section 012300 for Alternate descriptions.	
Add Alternate # 3-1	+ \$
<b>UNIT PRICES:</b>	
Should the contract work be increased or decreased as per the General Conditions of the Contract, Article 8, Changes in the Work, the bidder hereby agrees that the following unit price is the basis for the extra or the credit. The price includes all labor, material, overhead, profit, administration, insurance, applicable taxes, and incidental or contributory items, or cost to the contractor and/or suppliers in connection therewith. The undersigned agrees to the following prices stipulated below as the amount of extra or credit to be applied to the contract for the increase or decrease in the scope of work if required during the course of the project. Refer to Specification Section 012200 for Unit Price descriptions.	
Unit Price EC#1 - Trench Rock	\$ /CY
Unit Price EC#2 - Replacement of Unsuitable Backfill Material	\$ /CY
<b>Acknowledgement by Bidder – Receipt of Addendum (please initial all boxes to verify)</b>	
No.1	No.2
No.3	No.4
No.5	No.6
No.7	No.8
<b>REFER TO PAGE SECTION 004101 FOR A COMPLETE LIST OF FORMS TO BE SUBMITTED WITH THE BID.</b>	
<b>NOTES:</b>	
<p>1). Method of Award: Award of Contract may be made to the Lowest Responsible Bidder by method as follows:</p> <ul style="list-style-type: none"> <li>•If the award is to be made on the basis of Base Bid only, it may be made to that responsible bidder whose Base Bid therefor is the lowest and responsive to the bid specifications.</li> <li>•If the award is to be made on the basis of the combination of Base Bid with Alternates, it may be made to that responsible bidder whose net bid on such combination is the lowest, using Alternates in any order elected by the Owner.</li> </ul> <p>The District reserves the right to award a contract to the lowest responsible bidder providing the required security within forty-five (45) days of the date opening of the bids. Bidders may not withdraw their respective bids for a period of forty-five (45) days after the bid opening date, unless otherwise authorized by law. To the fullest extent allowed by law, the District further reserves the right to award the contract with or without alternates, using alternates in any order elected by the owner, whichever is deemed to be in the best interests of the District.</p> <p>The District further reserves the right to reject bids that contain conditions, omissions, exceptions or modifications, or in its sole discretion to waive any irregularities in the bids, or to reject any or all bids or to accept any bid which in the opinion of the District is in its best interest.</p> <p>2). On acceptance of the bid for the work, the undersigned hereby binds himself/herself/themselves to enter into a written contract with the Board of Education within ten (10) days of the notice of award, and to comply in all respects with the requirements and provisions set forth in the Bid Specifications, including but not limited to the Bid Instructions and the General Conditions in relation to security for the faithful performance of the terms of said contract.</p>	
<b>Signature:</b>	
<b>Printed Name of Person Signing:</b>	
<b>Title of Person Signing:</b>	



SECTION 004116 - BID FORM  
MOUNT PLEASANT CSD  
New Maintenance Building  
Contract #4 - Plumbing Construction  
State Plan #66-08-01-06-3-012-001

<b>BUSINESS NAME:</b>	
<b>ADDRESS:</b>	
<b>TELEPHONE NO.:</b>	
<b>FAX NO.:</b>	
<b>CONTRACT #4 (PC): Base Bid</b>	<b>\$ (SubTotal)</b>
<b>CONTRACT #4 (PC-1): Allowance</b>	<b>\$10,000.00</b>
<b>CONTRACT #4 (PC-2): Allowance - Rock Removal</b>	<b>\$</b>
<b>CONTRACT #4 (PC-3): Allowance - Unsuitable Soil</b>	<b>\$</b>
<b>CONTRACT #4 (PC): Combined Base Bid (Sum)</b>	<b>\$ (Total)</b>
<b>ALTERNATES:</b>	
The following amounts proposed for identified work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner chooses 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. Specification Section 012300 for Alternate descriptions.	
Add Alternate # 4-1	+ \$
<b>UNIT PRICES:</b>	
Should the contract work be increased or decreased as per the General Conditions of the Contract, Article 8, Changes in the Work, the bidder hereby agrees that the following unit price is the basis for the extra or the credit. The price includes all labor, material, overhead, profit, administration, insurance, applicable taxes, and incidental or contributory items, or cost to the contractor and/or suppliers in connection therewith. The undersigned agrees to the following prices stipulated below as the amount of extra or credit to be applied to the contract for the increase or decrease in the scope of work if required during the course of the project. Refer to Specification Section 012200 for Unit Price descriptions.	
Unit Price PC#1 - Trench Rock	\$ /CY
Unit Price PC#2 - Replacement of Unsuitable Backfill Material	\$ /CY
<b>Acknowledgement by Bidder – Receipt of Addendum (please initial all boxes to verify)</b>	
No.1	No.2
No.3	No.4
No.5	No.6
No.7	No.8
<b>REFER TO PAGE SECTION 004101 FOR A COMPLETE LIST OF FORMS TO BE SUBMITTED WITH THE BID.</b>	
<b>NOTES:</b>	
<p>1). Method of Award: Award of Contract may be made to the Lowest Responsible Bidder by method as follows:</p> <ul style="list-style-type: none"> <li>•If the award is to be made on the basis of Base Bid only, it may be made to that responsible bidder whose Base Bid therefor is the lowest and responsive to the bid specifications.</li> <li>•If the award is to be made on the basis of the combination of Base Bid with Alternates, it may be made to that responsible bidder whose net bid on such combination is the lowest, using Alternates in any order elected by the Owner.</li> </ul> <p>The District reserves the right to award a contract to the lowest responsible bidder providing the required security within forty-five (45) days of the date opening of the bids. Bidders may not withdraw their respective bids for a period of forty-five (45) days after the bid opening date, unless otherwise authorized by law. To the fullest extent allowed by law, the District further reserves the right to award the contract with or without alternates, using alternates in any order elected by the owner, whichever is deemed to be in the best interests of the District.</p> <p>The District further reserves the right to reject bids that contain conditions, omissions, exceptions or modifications, or in its sole discretion to waive any irregularities in the bids, or to reject any or all bids or to accept any bid which in the opinion of the District is in its best interest.</p> <p>2). On acceptance of the bid for the work, the undersigned hereby binds himself/herself/themselves to enter into a written contract with the Board of Education within ten (10) days of the notice of award, and to comply in all respects with the requirements and provisions set forth in the Bid Specifications, including but not limited to the Bid Instructions and the General Conditions in relation to security for the faithful performance of the terms of said contract.</p>	
<b>Signature:</b>	
<b>Printed Name of Person Signing:</b>	
<b>Title of Person Signing:</b>	



SURETY'S CONSENT

MOUNT PLEASANT CENTRAL SCHOOL DISTRICT

KNOW ALL MEN BY THESE PRESENTS, that \_\_\_\_\_ a  
Corporation of the State of \_\_\_\_\_ having its principal office at  
\_\_\_\_\_ and \_\_\_\_\_ a Company/  
Corporation in the State of \_\_\_\_\_ having its principal office at  
\_\_\_\_\_ being (a) surety company (is)  
qualified to do business in the State of New York in consideration of the premises and of One Dollar to it  
(them) in hand paid by the Owner, and of other good and valuable considerations, the receipt thereof is  
hereby acknowledged, do (as) consent and agree, that if the contract for which the preceding bid or  
proposal is made be awarded to the person or persons making the security, for the full and faithful  
performance of said work, and, for the protection of all persons performing or furnishing labor or materials  
for the performance of said contract in the form required; the performance bond and the labor and  
material obligations to be in an amount equal to 100% of the contract price, and to be conditioned so as  
to indemnify the Owner against loss due to the failure of the Contractor to meet the stipulations of said  
bond; and if the said person or persons shall omit or refuse to execute such contract and give the proper  
security within ten (10) days after written notice that same is ready for execution, if so awarded, and if  
sum, which the Owner may be obliged to pay to the person or persons by whom the contract shall be  
finally executed, exceeds the sum to which the person or persons making this bid or proposal would be  
entitled, then, the said surety company or companies will pay, without proof of notice or demand, to the  
Owner the amount of any such excess; the sums in each case to be calculated upon the estimated  
quantities of work, labor and materials by which the bids are tested.

\_\_\_\_\_  
Surety

\_\_\_\_\_  
Contractor

\_\_\_\_\_  
Surety

\_\_\_\_\_  
As To Surety

\_\_\_\_\_  
By Attorney





CERTIFICATE OF BIDDER  
MOUNT PLEASANT CENTRAL SCHOOL DISTRICT

Pursuant to the laws of the State of New York, the undersigned does herewith certify to the Owner that it owns, leases or controls all of the necessary equipment required to perform the work shown and described on the plans, specifications, and contract drawings for the **NEW MAINTENANCE BUILDING**.

The undersigned does further certify to the Owner that it is financially responsible and financially capable of accomplishing the work to be performed under the said contract above mentioned.

The undersigned does further certify to the Owner that it is fully qualified to perform the work under the said contract above mentioned.

IN WITNESS WHEREOF, the undersigned has caused this Certificate to be executed this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

\_\_\_\_\_  
President

Sworn and subscribed to  
before me this \_\_\_\_\_ day  
of \_\_\_\_\_, \_\_\_\_\_.

\_\_\_\_\_  
Notary Public



## QUALIFICATIONS OF BIDDERS

**Experience and Qualifications of the Bidder:** Each bidder is required to submit the following documentation to demonstrate its experience and qualifications for the work of the Project for which a bid is submitted:

- a. A description of its experience with projects of comparative size, complexity, and cost, together with documentary evidence showing that said projects were completed to the Owner's satisfaction and were completed in a timely fashion;
- b. Documentation from each of the projects it has performed capital work in the last five (5) years concerning the bidder's:
  - (i) timeliness of performance of the work of the project
  - (ii) evidence that the project was completed to the Owner's satisfaction;
  - (iii) whether or not any extensions of time were requested by the contractor and whether or not such requests were granted;
  - (iv) whether litigation and/or arbitration was commenced by either the Owner or the bidder as a result of the work of the project performed by the bidder;
  - (v) whether any liens were filed on the project by subcontractors or material suppliers of the bidder;
  - (vi) whether the bidder was defaulted on the project by the owner;
  - (vii) whether the bidder made any claims for extra work on the project, including whether said claim resulted in a change order;
- c. Documentation evidencing the bidder's financial responsibility, including a certified financial statement prepared by a certified public accountant.
- d. Documentation evidencing the bidder's existence under the same name for the last five (5) years.
- e. Documentation evidencing the bidder's Worker's Compensation Experience Modification.



## STATEMENT OF BIDDER'S QUALIFICATIONS

**IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE ANSWER TO ALL OF THE QUESTIONS IN THIS STATEMENT. IN THE EVENT A COMPLETE ANSWER IS NOT PROVIDED, THE BID WILL BE REJECTED.**

1. Name of Bidder

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2. Type of Business Entity

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3. If the bidder is a corporation, state the date and place of incorporation of the corporation.

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4. For how many years has the bidder done business under its present name?

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5. List the persons who are directors, officers, owners, managerial employees or partners in the bidder's business.

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6a. Have any of the persons listed in Number 5 owned/operated/been shareholders in any other companies? If so, please state name of owned/operated/been shareholders and names of other companies:

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6b. If the answer to number 6a is in the affirmative, list said persons and the names of their previous affiliations.

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7. Has any director, officer, owner or managerial employee had any professional license suspended or revoked? If the answer to this question is yes, list the name of the individual, the professional license he/she formerly held, whether said license was revoked or suspended and the date of the revocation or suspension.

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8. Has the bidder been found guilty of any OSHA Violations? If the answer to this question is yes, describe the nature of the OSHA violation, an explanation of remediation or other steps taken regarding such violation(s).

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9. Has the bidder been charged with any claims pertaining to unlawful intimidation or discrimination against any employee by reason of race, creed, color, disability, sex or natural origin and/or violations of an employee's civil rights or equal employment opportunities? If the answer to this question is yes, list the persons making such claim against the bidder, a description of the claim, the status of the claim, and what disposition (if any) has been made regarding such claim.

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10. Has the bidder been named as a party in any lawsuit arising from performance of work related to any project in which it has been engaged? If the answer to this question is yes, list all such lawsuits, the index number associated with said suit and the status of the lawsuit at the time of the submission of this bid.

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11. Has the bidder been the subject of an investigation and/or proceedings before the Department of Labor for alleged violations of the Labor Law as it relates to the payment of prevailing wages and/or supplemental payment requirements? If the answer to this question is yes, please list each such instance of the commencement of a Department of Labor proceeding, for which project such proceeding was commenced, and the status of the proceeding at the time of the submission of this bid.

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12. Has the bidder been the subject of an investigation and/or proceeding before any law enforcement agency, including, but not limited to any District Attorney's Office? If the answer to this question is yes, please list each such instance, the law enforcement agency, the nature of the proceeding, the project for which such proceeding was commenced, if applicable to a project, and the status of the proceeding at the time of the submission of this bid.

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13. Has the bidder been the subject of proceedings involving allegations that it violated the Workers' Compensation Law including but not limited to the failure to provide proof of worker's compensation or disability coverage and/or any lapses thereof. If the answer to this question is yes, list each such instance of violation and the status of the claimed violation at the time of the submissions of this bid.

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14. Has the bidder, its officers, directors, owner and/or managerial employees been convicted of a crime or been the subject of a criminal indictment? If the answer to this question is yes, list the name of the individual convicted or indicted, the charge against the individual and the date of disposition of the charge.

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15. Has the bidder been charged with and/or found guilty of any violations of federal, state, or municipal environmental and/or health laws, codes, rules and/or regulations? If the answer to this question is yes, list the nature of the charge against the bidder, the date of the charge, and the status of the charge at the time of the submission of this bid.

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16. Has the bidder bid on any projects for the period September 1, 2012 to present? If the answer to this question is yes, list the projects bid on, whether said bid was awarded to the bidder and the expected date of commencement of the work for said project. For those projects listed, if the bidder was not awarded the contract, state whether the bidder was the lowest monetary bidder.

**IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE LIST OF PROJECTS AS REQUIRED BY THIS QUESTION #16 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED.**

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17. Does the bidder have any projects ongoing at the time of the submission of this bid? If the answer to this question is yes, list the projects on which the bidder is currently working, the percentage complete, and the expected date of completion of said project.

**IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE LIST OF PROJECTS AS REQUIRED BY THIS QUESTION #17 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED.**

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18. Has the bidder ever been terminated from a Project by the Owner? If the answer to this question is yes, list the projects on which the bidder was terminated, the nature of the termination (convenience, suspension, for cause), and the date of said termination.

**IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE LIST OF PROJECTS AS REQUIRED BY THIS QUESTION #18 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED.**

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19. Has the bidder's surety ever been contacted to provide supervisory services in connection with an on-going project. If the answer to this question is yes, list the project(s) for which the surety provided supervisory services.

**IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE LIST OF PROJECTS AS REQUIRED BY THIS QUESTION #19 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED.**

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20. Bidder's Worker's Compensation Experience Modifier: \_\_\_\_\_

Dated:

By: \_\_\_\_\_

(Signature)

\_\_\_\_\_  
(Print Name and Title)

Sworn to before me this  
\_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

\_\_\_\_\_  
Notary Public



BIDDER'S PERSONNEL  
MOUNT PLEASANT CENTRAL SCHOOL DISTRICT

Give names of all officers of the corporation:

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Give the names of the executive, principal, or superintendent who will give personal attention to the work wherever required:

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## CONFLICT OF INTEREST CERTIFICATE

Pursuant to Section 2:4-15 of the Administrative Code of the State of New York, the undersigned does herewith certify that no officer or employee is interested in this contract, nor shall he participate in any profits with the undersigned or any other person, or receive any compensation, commission, gift, or other reward for his services, except the salary or fees established by law or by ordinance or resolution of the council.

IN WITNESS WHEREOF, the undersigned has caused this certificate to be executed this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

Sworn and subscribed to before me this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

\_\_\_\_\_  
President  
(Or Authorized Agent of Corporation)

\_\_\_\_\_  
Secretary





FORM OF DISCLOSURE

**THE UNDERSIGNED AFFIRMS THAT THE FOLLOWING CONSTITUTE ALL OFFICERS, DIRECTORS, PARTNERS, OR CONTROLLING PRINCIPALS OF THE FIRM:**

Name

Title

\_\_\_\_\_  
\_\_\_\_\_

1. Does any School District Board Member, administrator, or employee possess any financial interest, directly or indirectly, in the firm? \_\_\_\_\_ If yes, set forth the basis upon which a financial interest exists in the firm:

\_\_\_\_\_  
\_\_\_\_\_

2. Has the firm or any of its officers, directors, partners, or controlling principals possessed any interest in transactions heretofore entered into with the School District? \_\_\_\_\_ If yes, please describe transaction(s):

\_\_\_\_\_  
\_\_\_\_\_

3. Does any direct relative of a member of the Board, administrators, or staff possess any financial interest, directly or indirectly, in the firm (for purpose of this inquiry a direct relative is to be defined as a parent, spouse, child or sibling)? \_\_\_\_\_ If yes, set forth below the School District Board Member, administrator, or staff member whose relation possess an interest and the relationship:

\_\_\_\_\_  
\_\_\_\_\_

THE UNDERSIGNED AFFIRMS THAT THE ABOVE STATEMENTS ARE TRUE AND UNDERSTANDS THAT ANY FALSE STATEMENT SHALL CONSTITUTE A VIOLATION OF THE PENAL CODE OR GENERAL MUNICIPAL LAW AS APPLICABLE.

Firm: \_\_\_\_\_

Signature: \_\_\_\_\_

Print Name: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_



**NON-COLLUSIVE FORM**  
**BID PROPOSAL CERTIFICATIONS**

Firm Name \_\_\_\_\_

Business Address \_\_\_\_\_

Telephone Number \_\_\_\_\_ Date of Bid \_\_\_\_\_

**I. General Bid Certification**

The bidder certifies that he will furnish, at the prices quoted, the materials, equipment and/or services as proposed on this Bid.

**II. Non-Collusive Bidding Certification**

The following statement is made pursuant to Section 103-D of the General Municipal Law, as amended by Chapter 675 of the Laws of 1966, and Section 139-D of the State Finance Law, as amended by Chapter 675 of the Laws of 1966, and Section 2604 of the Public Authorities Law, as amended by Chapter 675 of the Laws of 1966.

By submission of this bid proposal, the bidder certifies that he/she is complying with Section 103-d of the General Municipal Law as follows:

Statement of non-collusion in bids and proposals to political subdivision of the state. Every bid or proposal hereafter made to a political subdivision of the state or any public department, agency or official thereof where competitive bidding is required by statute, rule, regulation, or local law, for work or services performed or to be performed or goods sold or to be sold, shall contain the following statement subscribed by the bidder and affirmed by such bidder as true under the penalties of perjury:

Non-collusive bidding certification.

A(a) By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief:

1. The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;

2. Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and,

3. No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

- (b) A bid shall not be considered for award nor shall any award be made where (a) (1) (2) and (3) above have not been complied with; provided, however, that if in any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish with the reasons therefor. Where (a) (1) (2) and (3) above have not been complied with, the bid shall not be considered for award nor shall any award be made unless the head of the purchasing unit of the political subdivision, public department agency or official thereof to which the bid is made or his designee, determines that such disclosure was not made for the purpose of restricting competition.

The fact that a bidder (a) has published price lists, rates, or tariffs covering items being procured, (b) has informed prospective customers of proposed or pending publication of new or revised price lists for such items, or (c) has sold the same items to other customers at the same prices being bid, does not constitute, without more, a disclosure within the meaning of subparagraph one (a).

Any bid hereafter made to any political subdivision of the state or any public department, agency or official thereof by a corporate bidder for work or services performed or to be performed or goods sold or to be sold, where competitive bidding is required by statute, rule, regulation, or local law, and where such bid contains the certifications referred to in subdivision II of this section, shall be deemed to have been authorized by the board of directors of the bidder, and such authorization shall be deemed to include the signing, and submission of the bid and the inclusion therein of the certificate as to non-collusion as the act and deed of corporation.

**The bidder affirms the above statement as true under the penalties of perjury.**

Signature of Bidder: \_\_\_\_\_  
(Signature of bidder or authorized representative of a corporation)

Title: \_\_\_\_\_

Sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_

**CERTIFICATION OF COMPLIANCE WITH THE IRAN DIVESTMENT ACT**

As a result of the Iran Divestment Act of 2012 (the "Act"), Chapter 1 of the 2012 Laws of New York, a new provision has been added to State Finance Law (SFL) § 165-a and New York General Municipal Law § 103-g, both effective April 12, 2012. Under the Act, the Commissioner of the Office of General Services (OGS) will be developing a list of "persons" who are engaged in "investment activities in Iran" (both are defined terms in the law) (the "Prohibited Entities List"). Pursuant to SFL § 165-a(3)(b), the initial list is expected to be issued no later than 120 days after the Act's effective date at which time it will be posted on the OGS website.

By submitting a bid in response to this solicitation or by assuming the responsibility of a Contract awarded hereunder, each Bidder/Contractor, any person signing on behalf of any Bidder/Contractor and any assignee or subcontractor and, in the case of a joint bid, each party thereto, certifies, under penalty of perjury, that once the Prohibited Entities List is posted on the OGS website, that to the best of its knowledge and belief, that each Bidder/Contractor and any subcontractor or assignee is not identified on the Prohibited Entities List created pursuant to SFL § 165-a(3)(b).

Additionally, Bidder/Contractor is advised that once the Prohibited Entities List is posted on the OGS Website, any Bidder/Contractor seeking to renew or extend a Contract or assume the responsibility of a Contract awarded in response to this solicitation must certify at the time the Contract is renewed, extended or assigned that it is not included on the Prohibited Entities List.

During the term of the Contract, should the School District receive information that a Bidder/Contractor is in violation of the above-referenced certification, the School District will offer the person or entity an opportunity to respond. If the person or entity fails to demonstrate that he/she/it has ceased engagement in the investment which is in violation of the Act within 90 days after the determination of such violation, then the School District shall take such action as may be appropriate including, but not limited to, imposing sanctions, seeking compliance, recovering damages or declaring the Bidder/Contractor in default. The School District reserves the right to reject any bid or request for assignment for a Bidder/Contractor that appears on the Prohibited Entities List prior to the award of a contract and to pursue a responsibility review with respect to any Bidder/Contractor that is awarded a contract and subsequently appears on the Prohibited Entities List.

I, \_\_\_\_\_, being duly sworn, deposes and says that he/she is the  
\_\_\_\_\_ of the \_\_\_\_\_ Corporation and that neither the  
Bidder/ Contractor nor any proposed subcontractor is identified on the Prohibited Entities List.

\_\_\_\_\_  
SIGNED

SWORN to before me this

\_\_\_\_\_ day of \_\_\_\_\_

201\_\_\_\_

Notary Public: \_\_\_\_\_



DECLARATION OF BIDDER'S INABILITY TO PROVIDE CERTIFICATION OF COMPLIANCE  
WITH THE IRAN DIVESTMENT ACT

*Bidders shall complete this form if they cannot certify that the bidder /contractor or any proposed subcontractor is not identified on the Prohibited Entities List. The District reserves the right to undertake any investigation into the information provided herein or to request additional information from the bidder.*

Name of the Bidder: \_\_\_\_\_

Address of Bidder: \_\_\_\_\_

Has bidder been involved in investment activities in Iran? \_\_\_\_\_  
Describe the type of activities including but not limited to the amounts and the nature of the investments  
(e.g. banking, energy, real estate) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

If so, when did the first investment activity occur? \_\_\_\_\_

Have the investment activities ended? \_\_\_\_\_

If so, what was the date of the last investment activity? \_\_\_\_\_

If not, have the investment activities increased or expanded since April 12, 2012? \_\_\_\_\_

Has the bidder adopted, publicized, or implemented a formal plan to cease the investment activities in Iran and to refrain from engaging in any new investments in Iran? \_\_\_\_\_

If so, provide the date of the adoption of the plan by the bidder and proof of the adopted resolution, if any and a copy of the formal plan. \_\_\_\_\_

In detail, state the reasons why the bidder cannot provide the Certification of Compliance with the Iran Divestment Act below (additional pages may be attached):  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

I, \_\_\_\_\_ being duly sworn, deposes and says that he/she is the \_\_\_\_\_ of  
the \_\_\_\_\_ Corporation and the foregoing is true and accurate.

\_\_\_\_\_  
SIGNED

SWORN to before me this

\_\_\_\_\_ day of \_\_\_\_\_

201\_\_\_\_

Notary Public: \_\_\_\_\_





SECTION 00 45 03 – INSURANCE CERTIFICATION FORM

Project No.: 66-08-01-06-3-012-001

Name of Project: Mount Pleasant CSD New Maintenance Building

Your insurance representative must complete the form below in order to be considered for the award of this bid or project, and it is important that you complete the Bidder's Acknowledgement section of this form. Please note that this Insurance Certification form must accompany your bid submission in order for your bid to be considered.

**Insurance Representative's Acknowledgement:**

We have reviewed the insurance requirements set forth in the Article 10 of the General Conditions for Construction located in the specifications and are capable of providing such insurance to our insured in accordance with such requirements in the event the contract is awarded to our insured and provided our insured pays the appropriate premium.

Insurance Representative:

\_\_\_\_\_

Address:

\_\_\_\_\_

\_\_\_\_\_

Are you an agent for the companies providing the coverage?

Yes\_\_\_\_No\_\_\_\_\_

Date:\_\_\_\_\_

**Bidder's Acknowledgement:**

I acknowledge that I have received the insurance requirements of this bid and have considered the costs, if any, of procuring the required insurance and will be able to supply the insurance required in accordance with the bid, if it is awarded. I understand that this Insurance Certification form must be submitted with my bid and my failure to provide may result in my being deemed non-responsive to the bid documents/ rejection of bid. The Mount Pleasant Central School District may award the contract to the next lowest/responsive bidder.

Firm name:

\_\_\_\_\_

Address:

\_\_\_\_\_

\_\_\_\_\_

Bidder's Signature

\_\_\_\_\_

\_\_\_\_\_



**HOLD HARMLESS AGREEMENT**

In accordance with Article 12 of the General Conditions, Indemnification, the Contractor will be required to sign the following "Hold Harmless" Agreement with the BOARD OF EDUCATION. Compliance with the foregoing requirements for insurance shall not relieve the Contractor from liability set forth under the Indemnity Agreement.

The undersigned hereby agrees to defend, indemnify, and save harmless the BOARD OF EDUCATION, its officers and employees from and against any and all liability, loss, damages, claims for bodily injury and/or property damages, cost and expense, including counsel fees, to the extent permissible by law, that may occur or that may be alleged to have occurred in the course of the performance of this agreement by the contractor, whether such claims shall be made by an employee of the contractor or by a third party, the contractor covenants and agrees that he will pay all costs and expenses arising therefrom and in connection therewith, and if any judgment shall be rendered against the Owner and/or Architect/Engineer, in any such litigation, the Contractor shall at his own expense satisfy and discharge the same.

By: \_\_\_\_\_  
(Signature of Authorized Representative of Corporation)

\_\_\_\_\_  
(Print Name and Title)

\_\_\_\_\_  
(Date)



## SECTION 004643 –WAGE AND HOUR RATES

### 1.01 GENERAL

- A. The following minimum wage rates, health and welfare and pension fund contributions are determined by the Industrial Commissioner of the State of New York in accordance with the provisions of Section 220 of the Labor Law.
- B. All contractors will be bound and obligated by the Laws of New York State to ensure payment to all workers involved with the construction of the project.

### 1.02 MINIMUM WAGE RATES

- A. The current wage and benefit rates are as set forth in the attached wage schedules.





Andrew M. Cuomo, Governor

Roberta Reardon, Commissioner

Mount Pleasant CSD

Veronica Moreno, LAN Associates  
252 Main Street  
2nd Floor  
Goshen NY 10924

Schedule Year 2021  
Date Requested 07/07/2021  
PRC# 2021007032

Location Maintenance Building  
Project ID# 4.1449.02  
Project Type Mount Pleasant CSD/New Maintenance Building

### PREVAILING WAGE SCHEDULE FOR ARTICLE 8 PUBLIC WORK PROJECT

Attached is the current schedule(s) of the prevailing wage rates and prevailing hourly supplements for the project referenced above. A unique Prevailing Wage Case Number (PRC#) has been assigned to the schedule(s) for your project.

The schedule is effective from July 2021 through June 2022. All updates, corrections, posted on the 1st business day of each month, and future copies of the annual determination are available on the Department's website [www.labor.ny.gov](http://www.labor.ny.gov). Updated PDF copies of your schedule can be accessed by entering your assigned PRC# at the proper location on the website.

It is the responsibility of the contracting agency or its agent to annex and make part, the attached schedule, to the specifications for this project, when it is advertised for bids and /or to forward said schedules to the successful bidder(s), immediately upon receipt, in order to insure the proper payment of wages.

Please refer to the "General Provisions of Laws Covering Workers on Public Work Contracts" provided with this schedule, for the specific details relating to other responsibilities of the Department of Jurisdiction.

Upon completion or cancellation of this project, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

#### NOTICE OF COMPLETION / CANCELLATION OF PROJECT

Date Completed: \_\_\_\_\_ Date Cancelled: \_\_\_\_\_

Name & Title of Representative: \_\_\_\_\_

Phone: (518) 457-5589 Fax: (518) 485-1870  
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12240





AGREEMENT made as of the \_\_\_\_ day of \_\_\_\_ in the year of Two Thousand Twenty \_\_\_\_.

BETWEEN the Owner  
(Name and Address)

and the Contractor:  
(Name and Address)

The Project is:  
(Name and Location)

The Architect is:  
(Name and Address)

The Construction Manager is:  
(Name and Address)

The Owner and Contractor agree as set forth below.

**ARTICLE 1**  
**THE CONTRACT DOCUMENTS**

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, specifications, Addenda issued prior to execution of this Agreement, other documents listed in Article 9 of this Agreement and Modifications issued after execution of this Agreement; these form the Contract and are a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than Modifications, appears in Article 9.

**ARTICLE 2**  
**THE WORK OF THIS CONTRACT**

The Contractor shall execute the entire Work described in the Contract Documents or reasonably inferable by the Contractor as necessary to produce the results intended by the Contract Documents, except to the extent specifically indicated in the Contract Documents to be the responsibility of others.

**ARTICLE 3**  
**DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION**

**3.1** The date of commencement of the work and substantial completion of the work of this contract shall be in accordance with the schedule set forth in the Project Manual.

**3.2** Time is of the essence respecting the contract documents and all obligations thereunder.

**3.3** Upon the execution of this Agreement, the Contractor shall provide the Owner with copies of all contracts entered into between the Contractor and subcontractors or material suppliers. The Contractor's obligation to provide the Owner with said contracts shall continue for the duration of the Project.

**ARTICLE 4**  
**CONTRACT SUM**

**4.1** The Owner shall pay the Contractor in current funds for the Contractor's performance of the Contract the Contract Sum of \_\_\_\_\_ Dollars and \_\_\_\_ Cents (\$\_\_\_\_\_), subject to additions and deductions as provided in the Contract Documents.

4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Bid Proposal Form (attached hereto) and are hereby accepted by the Owner.

4.3 Unit prices are as set forth in Exhibit A hereto.

4.4 Contingency Allowance as set forth in Exhibit A hereto:

## **ARTICLE 5**

### **PROGRESS PAYMENTS**

5.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

5.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

All progress payments shall be based upon an estimate and a certificate, made by the Architect, of the materials furnished, installed and suitably stored at the site and the work done by the Contractor, and payment shall be made in installments of ninety-five percent (95%) of the amount certified as earned so that, at the completion of the work, there will be a retainage of five percent (5%) of the Total Contract Sum. Retainage shall be paid to the Contractor upon final completion of the work of this contract. All progress payments made previous to the last and final payment shall be based on estimates and the right is hereby reserved by the Architect for the Owner to make all due and proper corrections in any payment for any previous error.

The Contractor shall submit with each application for payment the following:

1. A current Sworn Statement from the Contractor setting forth all subcontractors and materialmen with whom the Contractor has subcontracted, the amount of such subcontract, the amount requested for any subcontractor or materialman in the application for payment and the amount to be paid to the Contractor from such progress payment;

2. Commencing with the second (2nd) Application for Payment submitted by the Contractor, duly executed so-called "after the fact" waivers of mechanics' and materialmen's liens from all subcontractors, materialmen and, when appropriate, from lower tier subcontractors, establishing receipt of payment or satisfaction of payment of all amounts requested on behalf of such entities and disbursed prior to submittal by the Contractor of the current Application for Payment, plus sworn

statements from all subcontractors, materialmen and, where appropriate, from lower tier subcontractors, covering all amounts described in this Paragraph 5.2;

3. Such other information, documentation and materials as the Owner or the Architect may require.

**5.3** Payment shall not be released to the Contractor until the Owner receives the following documentation:

1. Certified payroll for employees and employees of subcontractors performing work on the Project.

2. Copies of invoices submitted to the Contractor by its subcontractors and/or material suppliers.

## **ARTICLE 6** **FINAL PAYMENT**

Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when (1) the Contract has been fully performed including compliance with all provisions of the Contract Documents except for the Contractor's responsibility to correct nonconforming Work under Article 15(B) of the General Conditions and to satisfy other requirements, if any, which necessarily survive final payment; and (2) a final Certificate for Payment has been issued by the Architect; such final payment shall be made by the Owner not more than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows or as soon thereafter as is practicable.

## **ARTICLE 7** **MISCELLANEOUS PROVISIONS**

**7.1** Where reference is made in this Agreement to a provision of the General Conditions or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

**7.2** The Contractor represents and warrants the following to the Owner (in addition to any other representations and warranties contained in the Contract Documents) as an inducement to the Owner to execute this Agreement, which representations and warranties shall survive the execution and delivery of this Agreement, any termination of this Agreement and the final completion of the Work:

1. that it and its Subcontractors are financially solvent, able to pay all debts as they mature and possessed of sufficient working capital to complete the Work and perform all obligations hereunder;

2. that it is able to furnish the plant, tools, materials, supplies, equipment and labor required to complete the Work and perform its obligations hereunder;

3. that it is authorized to do business in the State of New York and the United States and properly licensed by all necessary governmental and public and quasi-public authorities having jurisdiction over it and over the Work and the Project;

4. that its execution of this Agreement and its performance thereof is within its duly authorized powers;

5. that its duly authorized representative has visited the site of the Project, is familiar with the local and special conditions under which the Work is to be performed and has correlated on-site observations with the requirements of the Contract Documents; and

6. that it possesses a high level of experience and expertise in the business administration, construction, construction management and superintendence or projects of the size, complexity and nature of the particular Project, and that it will perform the Work with the care, skill and diligence of such a contractor.

The foregoing warranties are in addition to, and not in lieu of, any and all other liability imposed upon the Contractor by law with respect to the Contractor's duties, obligations and performance hereunder. The Contractor's liability hereunder shall survive the Owner's final acceptance of and payment for the Work. All representations and warranties set forth in this Agreement, including without limitation, this Paragraph 7.2, shall survive the final completion of the Work or the earlier termination of this Agreement. The Contractor acknowledges that the Owner is relying upon the Contractor's skill and experience in connection with the Work called for hereunder.

## **ARTICLE 8**

### **TERMINATION OR SUSPENSION**

**8.1** The Contract may be terminated by the Owner as provided in the General Conditions.

**8.2** The Work may be suspended by the Owner as provided in the General Conditions.

**ARTICLE 9**  
**ENUMERATION OF CONTRACT DOCUMENTS**

**9.1** The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated as follows:

**9.1.1** The Agreement is this executed Agreement between Owner and Contractor.

**9.1.2** The General Conditions are the General Conditions of the Contract for Construction as set forth in the Project Manual and attached hereto.

**9.1.3** The Specifications are as set forth in the Project Manual and indexed in Exhibit "B" hereto.

**9.1.4** The Drawings are those as indexed in Exhibit "C" hereto.

**9.1.5** The Addenda, if any, are as follows:

Addendum No.	Date	Number of Pages
--------------	------	-----------------

**This Agreement is entered into as of the day and year first written above and is executed in at least four original copies of which one is to be delivered to the Contractor, one to the Architect for use in the administration of the Contract, and the remainder to the Owner.**

OWNER

CONTRACTOR

By \_\_\_\_\_  
(Signature) President

By \_\_\_\_\_  
(Signature) President

\_\_\_\_\_  
(Printed name and title)

\_\_\_\_\_  
(Printed name and title)

SECTION 006100 – BOND REQUIREMENTS  
See the conditions set forth in Article 11 of the General Conditions

- 1.01 Prior to Owner signing the contract agreement, he will require the Contractor (s) to furnish separate performance and labor and material payment bonds covering the faithful performance of the entire construction contract agreement.

The performance bond and the labor and material payment bond shall each be made out in one hundred percent (100%) of the guaranteed maximum contract amount.

- 1.02 The Contractor (s) shall include in his proposal amount the total premiums for the performance and labor and material payment bonds.





# AIA<sup>®</sup> Document A310<sup>™</sup> – 2010

## **Bid Bond**

**CONTRACTOR:**

*(Name, legal status and address)*

**SURETY:**

*(Name, legal status and principal place of business)*

**OWNER:**

*(Name, legal status and address)*

**BOND AMOUNT: \$****PROJECT:**

*(Name, location or address, and Project number, if any)*

Uninterruptible Power Supply (UPS)

**ADDITIONS AND DELETIONS:**

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Init.

Signed and sealed this    day of    ,

\_\_\_\_\_  
(Contractor as Principal)

\_\_\_\_\_  
(Seal)

\_\_\_\_\_  
(Witness)

\_\_\_\_\_  
(Title)

\_\_\_\_\_  
(Surety)

\_\_\_\_\_  
(Seal)

\_\_\_\_\_  
(Witness)

\_\_\_\_\_  
(Title)

Init.



# AIA® Document A312™ – 2010

## Performance Bond

**CONTRACTOR:**

(Name, legal status and address)

**SURETY:**

(Name, legal status and principal place of business)

**OWNER:**

(Name, legal status and address)

**CONSTRUCTION CONTRACT**

Date:

Amount: \$

Description:

(Name and location)

Uninterruptible Power Supply (UPS)

**BOND**

Date:

(Not earlier than Construction Contract Date)

Amount: \$

Modifications to this Bond: ☐ None ☐ See Section 16

**CONTRACTOR AS PRINCIPAL**

Company: (Corporate Seal)

**SURETY**

Company: (Corporate Seal)

Signature: \_\_\_\_\_

Name and

Title:

Signature: \_\_\_\_\_

Name and

Title:

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

**AGENT or BROKER:**

**OWNER'S REPRESENTATIVE:**

(Architect, Engineer or other party:)

**ADDITIONS AND DELETIONS:**

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

- .1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;
- .2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
- .3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

- .1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
- .2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

- .1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
- .2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and
- .3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

#### § 14 Definitions

§ 14.1 **Balance of the Contract Price.** The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 **Construction Contract.** The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 **Contractor Default.** Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 **Owner Default.** Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 **Contract Documents.** All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

*(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)*

**CONTRACTOR AS PRINCIPAL**

Company: \_\_\_\_\_  
(Corporate Seal)

Signature: \_\_\_\_\_  
Name and Title: \_\_\_\_\_  
Address: \_\_\_\_\_

**SURETY**

Company: \_\_\_\_\_  
(Corporate Seal)

Signature: \_\_\_\_\_  
Name and Title: \_\_\_\_\_  
Address: \_\_\_\_\_

Init.



# AIA<sup>®</sup> Document A312<sup>™</sup> – 2010

## Payment Bond

**CONTRACTOR:**

(Name, legal status and address)

**SURETY:**

(Name, legal status and principal  
place of business)

**OWNER:**

(Name, legal status and address)

This document has important  
legal consequences.  
Consultation with an attorney  
is encouraged with respect to  
its completion or modification.

**CONSTRUCTION CONTRACT**

Date:

Amount: \$

Description:

(Name and location)

Any singular reference to  
Contractor, Surety, Owner or  
other party shall be considered  
plural where applicable.

**BOND**

Date:

(Not earlier than Construction Contract Date)

Amount: \$

Modifications to this Bond: ☐ None ☐ See Section 18

**CONTRACTOR AS PRINCIPAL**

Company: (Corporate Seal)

**SURETY**

Company: (Corporate Seal)

Signature: \_\_\_\_\_

Name and

Title:

Signature: \_\_\_\_\_

Name and

Title:

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

**AGENT or BROKER:**

**OWNER'S REPRESENTATIVE:**

(Architect, Engineer or other party.)

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

- .1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
- .2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.



§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

## § 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- .1 the name of the Claimant;
- .2 the name of the person for whom the labor was done, or materials or equipment furnished;
- .3 a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- .4 a brief description of the labor, materials or equipment furnished;
- .5 the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- .6 the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- .7 the total amount of previous payments received by the Claimant; and
- .8 the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

**§ 16.4 Owner Default.** Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

**§ 16.5 Contract Documents.** All the documents that comprise the agreement between the Owner and Contractor.

**§ 17** If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

**§ 18** Modifications to this bond are as follows:

*(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)*

**CONTRACTOR AS PRINCIPAL**

Company: \_\_\_\_\_ (Corporate Seal)

Signature: \_\_\_\_\_  
Name and Title: \_\_\_\_\_  
Address: \_\_\_\_\_

**SURETY**

Company: \_\_\_\_\_ (Corporate Seal)

Signature: \_\_\_\_\_  
Name and Title: \_\_\_\_\_  
Address: \_\_\_\_\_

SECTION 006300 – REQUESTS FOR INFORMATION (RFI)  
Coordinate with Subpara 6(T)(2) of the General Conditions

PART 1 - GENERAL

- 1.01 This document is for issuance at the Post Bid/Pre-Construction Conference and specifies administrative and procedural requirements for handling requests for information (RFI's) made after award of Contract.
- 1.02 Attention is directed to Sections 013300 and 013200 of Division #1 as same concerns construction progress schedules, submittals of shop drawings, samples and product data in general.
- 1.03 SUBMITTALS PROCEDURES: RFI's shall be submitted in the following manner:
- A. One (1) completed copy of form following to Architect with copies to Owner (as directed) and appropriate Consultants with the following minimum information:
1. Work identified by RFI listing affected Drawing(s) and specific detail(s) and Specification paragraph reference(s).
  2. Identify specific field conditions and "as-built" conditions on sketches attached to RFI submittal.
  3. If RFI addresses conflict(s) in, or between Contract Documents, describe completely and provide such data necessary to permit thorough and proper response by affected discipline.
  4. Indicate proposed solution along with any impacts on cost and construction time.
  5. Listing of Trade/Specialty Contractors affected by RFI and indication that RFI proposal has been coordinated with said contractors.

INCOMPLETE RFI'S WILL BE RETURNED TO CONTRACTOR WITHOUT ACTION  
TAKEN.

- 1.04 REVIEW PROCEDURES/ACTIONS
- A. Architect/Engineer may request additional information or documentation as may be deemed necessary for fair evaluation of RFI.
- B. Architect/Engineer will respond with reasonable promptness as outlined in Section 013300 in writing and may, if deemed appropriate issue a "Bulletin" (as defined in the General Conditions) as a clarification to the Contract Documents.



# DRAFT AIA® Document G716™ – 2004

## Request for Information ("RFI")

TO:	FROM:	
PROJECT:	ISSUE DATE:	RFI No. 001
PROJECT NUMBERS: /	REQUESTED REPLY DATE: COPIES TO:	
RFI DESCRIPTION: <i>(Fully describe the question or type of information requested.)</i>		
REFERENCES/ATTACHMENTS: <i>(List specific documents researched when seeking the information requested.)</i>		
SPECIFICATIONS:	DRAWINGS:	OTHER:
SENDER'S RECOMMENDATION: <i>(If RFI concerns a site or construction condition, the sender may provide a recommended solution, including cost and/or schedule considerations.)</i>		
RECEIVER'S REPLY: <i>(Provide answer to RFI, including cost and/or schedule considerations.)</i>		
BY	DATE	COPIES TO

**Note:** This reply is not an authorization to proceed with work involving additional cost, time or both. If any reply requires a change to the Contract Documents, a Change Order, Construction Change Directive or a Minor Change in the work must be executed in accordance with the Contract Documents.



***GENERAL CONDITIONS***  
***of the***  
***CONTRACT for CONSTRUCTION***

## TABLE OF CONTENTS

ARTICLE 1 - DEFINITIONS.....	3
ARTICLE 2 - CONTRACTOR'S REPRESENTATIONS.....	5
ARTICLE 3 - CONTRACTOR'S CONSTRUCTION PROCEDURES.....	6
ARTICLE 4 - CONTRACTOR'S USE OF SITE.....	13
ARTICLE 5 - SUBCONTRACTORS.....	21
ARTICLE 6 - CONTRACTOR'S USE OF DRAWINGS/SPECIFICATIONS.....	23
ARTICLE 7 - CONTRACTOR'S SAFETY/SECURITY PROGRAM .....	32
ARTICLE 8 - CHANGES IN THE WORK .....	38
ARTICLE 9 - PAYMENTS.....	42
ARTICLE 10 - RESERVED .....	48
ARTICLE 11 - MT. PLEASANT CSD INSURANCE AND BONDS .....	48
ARTICLE 12 - INDEMNIFICATION.....	58
ARTICLE 13 - TIME FOR COMPLETION OF WORK.....	60
ARTICLE 14 - DEFICIENT AND INCOMPLETE WORK.....	63
ARTICLE 15 - FINAL COMPLETION AND CLOSEOUT OF THE PROJECT.....	65
ARTICLE 16 - RELEVANT STATUTORY PROVISIONS.....	67
ARTICLE 17 - TERMINATION OR SUSPENSION.....	71
ARTICLE 18 - CLAIMS AND DISPUTES.....	74
ARTICLE 19 - MISCELLANEOUS PROVISIONS.....	75



## **GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION**

The within document includes detailed provisions concerning the capital improvement work to be performed by the Contractors engaged by the School District. This document contains provisions which relate particularly to capital improvement projects in the school district setting in New York State. The document is incorporated by reference into all contracts to be awarded and should be reviewed carefully by the Contractor to whom the award of contract is made. Consultation with an attorney and insurance representative is advised.

### **ARTICLE 1 DEFINITIONS**

1. "Addendum" or "Addenda" refers to revised drawings and/or written requirements for the capital improvement work issued by the Architect prior to the time indicated for submission of a bid by a contractor.
2. The "Architect" is the design professional engaged by the School District to perform design related functions respecting the capital improvement projects to be performed in the School District.
3. "Board of Education" refers to the Board of Education of the School District.
4. "Central Administration" refers to the Superintendent of Schools, his/her Assistant Superintendents, and Director of Plant & Facilities.
5. The "Construction Manager" is the entity engaged by the School District to act as its representative during the course of construction of the Project.
6. The "Contractor" refers to the entity engaged by the School District to perform all or a part of the capital improvement project on its behalf.
7. The "Drawings" are the plans, elevations, sections, details, schedules and diagrams developed by the Architect for the capital improvement projects to be performed in accordance with the project manual of which these General Conditions of the Contract for Construction form a part.
8. The "Project" refers to the entire capital improvement project to be performed in accordance with the project manual and may include work by the Owner.
9. The "Project Manual" is the bound document which is issued simultaneously with the project Drawings and includes the Notice to Bidders, Information to Bidders, Bid Proposal Form, Prevailing Wage Rate schedule and the written requirements for labor, materials, equipment, construction systems and the like necessary for the Contractor to complete the capital improvement work for which it has been engaged.

10. The "Owner" refers to the School District, the Board of Education, its officers, agents and employees.

11. A "Subcontractor" is a person or entity who has a direct contract with the Contractor to provide material and/or labor for the project on or off the site, or to otherwise furnish labor, material or other services with respect to a portion of the Contractor's work. A "Sub-subcontractor" is a person or entity who has a direct or indirect contract with a Subcontractor engaged by the Contractor to perform a portion of the Subcontractor's work at the site, or to otherwise furnish labor, material or other services with respect to a portion of the Subcontractor's work.

12. The term "Specialist" or "Specialty Contractor" as used in these specifications shall mean an individual or firm of established reputation, or, if newly organized, whose personnel have previously established a reputation in the same field, which is regularly engaged in, and which maintains a regular force of workers skilled in either manufacturing or fabricating items required by the Contract, installing items required by the Contract, or otherwise performing work required by the Contract.

13. "Accepted", "directed" "permitted," "requested," "required," and "selected" mean, unless otherwise explained, "accepted by the Architect and/or Owner" "directed by the Architect and/or Owner," "permitted by the Architect and/or Owner," "requested by the Architect and/or Owner," "required by the Architect and/or Owner," and "selected by the Architect and/or Owner." However, no such implied meaning will be interpreted to extend the Architect's responsibility into the Contractor's area of construction supervision.

14. "As accepted" "or acceptable substitute", and "for review" mean the Architect is the sole judge of the quality and suitability of the proposed substitutions. Where used in conjunction with the Architect's response to submittals, requests, applications, inquiries, reports, and claims by the Contractor, the meaning will be held to the limitations of the Architect's responsibilities and duties as stated in the General Conditions. In no case will "accepted by the Architect" be interpreted as an assurance to the Contractor that the requirements of the Contract Documents have been fulfilled.

15. "Furnish" means supply and deliver to the Project site or other designated location, ready for unloading, unpacking, storing, assembly, installation, application, erection, or other form of incorporation into the Project, and maintained ready for use. Supply and deliver products requiring additional or supplemental fitting, assembly, fabrication, or incorporation into other elements of the Project directly to the fabricator, installer or manufacturer as required.

16. "Install" means unload, unpack, use, fit, attach, assemble, apply, place, anchor, erect, finish, cure, protect, clean, and similar operations required to properly incorporate work into the Project.

17. "Provide" means furnish and install.

18. "Replace" means remove designated, damaged, rejected, defective, unacceptable, or non-conforming work from the Project and provide new work meeting the requirements of the Contract Documents in place thereof.

19. The word "include", in any form other than "inclusive", is non-limiting and is not intended to mean all-inclusive.

## **ARTICLE 2 CONTRACTOR'S REPRESENTATIONS**

A. Upon submission of its bid to the Owner, the Contractor expressly represents:

1. The Contractor represents and warrants that it performed a detailed investigation of the site(s) and that such investigation was sufficient to disclose the conditions of the site(s) at which work is to be performed by it and all improvements thereon, and the conditions under which the work is to be performed, including, but not limited to (a) the location, condition, layout and nature of the project site and surrounding areas; (b) the cost of labor, materials and equipment necessary to perform the work, the availability; (c) the areas of the work which will cause a disruption to the necessary and proper operation of the facilities by the Owner; and (d) other pertinent limitations on the performance of its work.

2. The Contractor represents and warrants that it has carefully studied and compared the drawings and pertinent provisions of the project manual and that any errors, omissions, ambiguities, discrepancies or conflicts found in said documents have been brought to the attention of the Architect for clarification prior to the Contractor's submission of its bid. If, in the interpretation of Contract Documents, requirements within the Drawings and Specifications conflict, or it appears that the Drawings and Specifications are not in agreement, the requirement to be followed shall be decided by the Architect. Where there is a discrepancy in quantity, the Contractor shall provide the greater quantity; where there is a discrepancy in quality, the Contractor shall provide the superior quality. Addenda supersede the provisions that they amend.

3. Each contractor certifies that it is experienced and familiar with the requirements and conditions imposed during the construction of similar work in the area. This includes, but is not limited to, "out of sequence" or "come back" work for the removal of plant, equipment, temporary wiring or plumbing, etc. This "out of sequence" work may also include phasing of construction activities to accommodate the installation of the work at various locations and orderly fashion and the completion of work at various locations and/or levels at various times. This "phasing", "out of sequence", or "come back" work shall be done at no cost to other contractors, the Owner, Architect or the Construction Manager.

B. The Contractor warrants to the Owner that (1) the materials and equipment furnished under its contract will be of good quality and new, and of recent manufacture, unless otherwise required or permitted by the Contract Documents, (2) that its work will be free from defects not inherent in the quality required or permitted, and (3) that its work will conform with the terms

and conditions of its agreement with the Owner. Work not conforming to these requirements, including substitutions not properly approved and authorized, shall be considered defective and shall be removed and replaced at the Contractor's cost and expense. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

C. Except as to any reported errors, inconsistencies or omissions, and to concealed or unknown conditions, by executing the Agreement, the Contractor represents the following:

1. The drawings and accompanying specifications found in the project manual issued simultaneously with said drawings are sufficiently complete and detailed for the Contractor to (a) perform the work required to produce the results intended by the Owner and (b) comply with all the requirements of its contract with the Owner.

2. The work required to be performed by the Contractor including, without limitation, all construction details, construction means, methods, procedures and techniques necessary to perform its work, use of materials, selection of equipment and requirements of product manufacturers are consistent with: (a) good and prevailing and accepted industry standards applicable to its work; (b) requirements of any warranties applicable to its work; and (c) all laws, ordinances, regulations, rules and orders which bear upon the Contractor's performance of its work.

3. The Drawings and Specifications for the Contract have been prepared with care and are intended to show as clearly as is practicable the work required to be done. Work under all items in the Contract must be carried out to meet field conditions to the satisfaction of the Architect and Owner and in accordance with his instructions and the Contract Drawings and Specifications.

4. All dimensions shown on the Drawings are for bidding purposes only. It is the responsibility of the Contractor to verify all dimensions in the field to insure proper and accurate fit of materials and items to be installed.

D. The representations set forth herein shall survive expiration and/or termination of the Contractor's agreement with the Owner.

### **ARTICLE 3 CONTRACTOR'S CONSTRUCTION PROCEDURES**

A. 1. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures required for the proper execution of its work on the project. Where the drawings and/or project manual make reference to particular construction means, methods, techniques, sequences or procedures or indicate or imply that such are to be used in connection with the Contractor's work, such reference is intended only to indicate that the Contractor's work is to produce at least the quality of the work implied by the operations described, but the actual determination as to whether or not the described operations

may be safely or suitably employed in the performance of the Contractor's work shall be the sole responsibility of the Contractor. All loss, damage, liability, or cost of correcting defective work arising from the employment of a specific construction means, method, technique, sequence or procedure shall be borne solely by the Contractor.

2. Neither the Architect, the Construction Manager or the Owner will have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility as provided herein.

3. The Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, rigging, water, heat, utilities, light, transportation, and other facilities and services necessary for proper execution and completion of its work, whether temporary or permanent and whether or not incorporated or to be incorporated in its work.

B. The Contractor shall be responsible for coordinating the work of its own forces and the work of subcontractors engaged by it to perform the work of the project on its behalf. The Contractor shall supply to its own work forces, and subcontractors engaged by it to perform portions of its work, copies of the drawings and project manuals for the work to be performed by such individuals/entities on its behalf. The Contractor shall review any specified or installation procedure with its employees and/or subcontractors, including those recommended by any product manufacturer, prior to the commencement of the relevant portion of the work to be performed. The Contractor shall be responsible to the Owner for the acts and/or omissions of the Contractor's employees, the Contractor's Subcontractors, the Contractor's material suppliers, and/or their respective agents and employees, and any other persons performing portions of the work on behalf of the Contractor.

C. The Contractor shall be responsible for the inspection of portions of the project performed by its own work force and/or subcontractors engaged by it for the purpose of determining that said work is in proper condition to receive subsequent work.

D. The Contractor shall perform its work in accordance with the standards of the construction industry applicable to work in the locale in which work is to be performed.

E. The Contractor shall only employ labor on the project or in connection with its work capable of working harmoniously with all trades, crafts and any other individuals associated with the capital improvement work to be performed. There shall be no strikes, picketing, work stoppages, slowdowns or other disruptive activity at the project for any reason by anyone employed or engaged by the Contractor to perform its portion of the work. There shall be no lockout at the project by the Contractor. The Contractor shall be responsible for providing the manpower required to proceed with the work under any circumstance. Should it become necessary to create a separate entrance for a contractor involved in a labor dispute, all costs associated with creating that entrance shall be borne by the contractor involved in the dispute. Such costs shall include, but not be limited to, signage, fencing, temporary roads and security personnel as deemed necessary by the Owner for the safety of the occupants of the site.

F. 1. If the Contractor has engaged the services of workers and/or subcontractors who are members of trade unions, the Contractor shall make all necessary arrangements to reconcile, without delay, damage or cost to the Owner and without recourse to the Architect, the Construction Manager or the Owner, any conflict between its agreement with the Owner and any agreements or regulations of any kind at any time in force among members or councils which regulate or distinguish what activities shall not be included in the work of any particular trade.

2. In case the progress of the capital improvement work to be performed by the Contractor is effected by any undue delay in furnishing or installing any items or materials or equipment required pursuant to its agreement with the Owner because of a conflict involving any such labor agreement or regulation, the Owner may require that other material or equipment of equal kind and quality be provided pursuant to a Change Order or Construction Change Directive but in no case shall the amount of such change be charged by the Contractor to the Owner as an additional cost to perform the capital improvement work pursuant to its contract.

3. The Contractor shall ensure that its work continues uninterrupted during the pendency of a labor dispute.

4. The Contractor shall be liable to the Owner for all damages suffered by the Owner occurring as a result of work stoppages, slowdowns, disputes or strikes.

G. The Contractor shall enforce strict discipline and good order among the Contractor's employees and its Subcontractors' work forces and other persons carrying out the performance of its work. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them. The Owner reserves the right to object to any person to be hired or who is employed by the Contractor. Upon the request of the Owner, said person shall be removed from the Project and not again be assigned to perform the Contractor's work without the written permission of the Owner.

H. Within one (1) week after a Notice to Proceed is received, the Contractor shall employ a competent, full-time Project Manager and On Site Superintendent to be approved by the Owner or its representative, and such necessary assistants who shall be in attendance at each project site whenever and wherever work is in progress to provide for the expeditious completion of the work. Said Project Manager and On Site Superintendent shall be employed until punchlist and closeout of the Project. To the extent work is being performed contemporaneously at different facilities within the School District, the Contractor shall assign different superintendents for each facility at which work is being performed. The Project Manager and On Site Superintendent assigned by the Contractor shall not be changed except with the consent of Owner, unless the Project Manager or On Site superintendent or such assistant proves to be unsatisfactory to the Contractor and/or ceases to be in its employ. The Project Manager and On Site Superintendent shall represent the Contractor, and communications given to the Project Manager or On Site Superintendent, whether verbal or written, shall be as binding as if given to the Contractor. Oral communications to the superintendent(s) or his/her assistant(s) and/or project manager shall be confirmed in writing by the Owner or Architect. The Contractor shall forward to the Owner a

copy of the resumes for each of its superintendents, project managers and their assistants. The Owner, the Construction Manager or the Architect shall have the right to have any supervisory or management staff removed from the project with or without cause.

I. Each Contractor shall provide, or otherwise see that, the project manager, or on site superintendent site managers, and/or responsible workers of each Contractor and major subcontractor are equipped with cellular phones and radios. Each Contractor shall provide the Owner, the Construction Manager and the Architect with the number for each phone and worker.

J. The Contractor's supervisory personnel, including superintendents and their assistants, shall be versed in the English language. In the event the Contractor's supervisory personnel, superintendents and/or their assistants are not versed in the English language, the Contractor shall employ the services of a full-time on-site interpreter to facilitate communications with such supervisory personnel, superintendents and/or assistants.

K. Prior to the commencement of work, the Contractor shall provide the Construction Manager and the Architect with:

1. a written list of the names, addresses and telephone numbers of the members of its organization who can be contacted in the event of an off-hours emergency at the building site, including cellular telephone numbers and personal/home telephone numbers.
2. a written list of subcontractors, sub-subcontractors, suppliers and vendors with names, addresses, telephone numbers, and descriptions of the work they shall perform or furnish.
3. The name, address and telephone number of the bonding company, banking and insurance company for the Prime Contractor employed by the Prime Contractor including the name, address and telephone number of each bonding company's primary contact representative for this project.
4. Detailed subcontractor schedules indicating the approximate quantity of shop drawings, sequence, timing and man loading.
5. A cash flow projection for the life of the project, including a schedule and graph showing the amount of work projected to be completed each month or billing period and a dollar value for the anticipated billings each month or billing period. This shall be completed after an agreed upon schedule of values has been approved by the Construction Manager.

L. 1. Tests, inspections and approvals of portions of the Contractor's work required by the drawings and/or specifications shall be made at an appropriate time. Unless otherwise provided, the Contractor shall consult with the Architect and the Construction Manager concerning the need for testing and/or inspection of its work pursuant to the Contract

Documents and, after consulting with the Architect and Construction Manager, the Construction Manager shall advise the Owner to make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority. The Owner shall bear all costs associated with the tests, inspections or approvals required by the drawings and/or specifications except as set forth in subparagraph 3 hereof.

2. Tests, inspections and approval of portions of the Contractor's work required by laws, ordinances, rules, regulations or orders of public authorities or governmental agency having jurisdiction shall be made at an appropriate time. The Contractor shall consult with the Architect and the Construction Manager concerning the need for testing and/or inspection of its work pursuant to law, ordinance, regulation or orders of public authorities or governmental agencies and shall advise the Owner in writing that it has made arrangements for such tests, inspections and approvals with the appropriate public authority or governmental agency. The Contractor shall be solely responsible for making timely notice of the need for a test, inspection and/or approval with the relevant public authority or governmental agencies and shall bear all costs associated with such testing, inspection or approval required by such public authority or governmental agency.

3. If the Architect, the Construction Manager, the Owner, or public authorities or governmental agencies having jurisdiction determine that portions of the Contractor's work require additional testing, inspection or approval due to the Contractor's failure to perform its work in accordance with the requirements of the Contract Documents and/or laws, ordinances, rules, regulations or orders of public authorities or governmental agencies having jurisdiction, the Architect and the Construction Manager will advise the Owner of the need for such additional inspections or tests and the Owner shall make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner. The Contractor shall bear the costs of such additional testing as provided in Article 14.

M. The Contractor shall, if required by ordinances, laws, codes, rules and/or regulations of the governing agencies having jurisdiction over this project, retain a licensed professional engineer to supervise the construction of this project including, but not limited to, foundations, structural work, soils, welding, reinforced masonry and the like.

N. The Contractor recognizes and acknowledges that the within project is governed by and subject to the provisions of New York State General Municipal Law, section 101, governing the award of contracts on public improvement projects. As such, the Contractor recognizes and acknowledges that other contractors will be performing work on the project in conjunction with it. As such the Contractor agrees to cooperate with such other contractors performing work on the project and shall perform its work as follows:

1. The Contractor shall not interfere with the erection, installation or storage upon the premises of any work, materials, supplies or equipment which is to be performed and furnished by other contractors, and the Contractor shall properly connect and coordinate its work therewith.



2. The Contractor shall not commit or permit any act which will interfere with the performance of the work of any other contractor performing work on the project. If the Contractor sustains any damage through any act or omission of other contractors having a contract with the Owner for the performance of work upon the site or of work which may be necessary to be performed for the proper execution of the work to be performed hereunder, or through any act or omission of a subcontractor of such contractor, the Contractor shall promptly notify the Owner and the Construction Manager of such damage.

3. The Contractor agrees to defend and indemnify Owner, Architect, Construction Manager, its Consultants and Sub-consultants, from all claims made against any of them arising out of Contractor's acts or omissions or the acts or omissions of any subcontractor of the Contractor which have caused damage to the Owner, Architect, Construction Manager or other contractor(s) on the project. The Owner's right to indemnification hereunder shall in no way be diminished, waived or discharged, or by the exercise of any other remedy provided for by the contract or by law. Further, the Owner shall withhold from an offending contractor's contract sum an amount sufficient to cover such damage and all expenses and costs associated with the damage sustained.

4. When the work of the Contractor or its subcontractors overlap or dovetail with that of other Contractors, materials shall be delivered and operations conducted to carry on the work continuously, in an efficient, workmanlike manner.

5. In case of interference between the operations of different Contractors, the Construction Manager will be the sole judge of the rights of each Contractor and shall have the authority to decide in what manner the work may proceed, and in all cases its decision shall be final. Any decision as to the method and times of conducting the work or the use of space as required in this paragraph shall not be basis of any claim for delay or damages by the Contractor.

6. The Contractor, including its subcontractors, shall keep itself informed of the progress of other contractors and shall notify the Architect or the Construction Manager immediately in writing of lack of progress on the part of other contractors where such delay will interfere with its own operations. Failure of the Contractor to keep informed of the work progressing on the project and failure to give notice of lack of progress by others shall be construed as acceptance by the Contractor of the status of the work as being satisfactory for proper coordination with the Contractor's own work.

7. Delays or oversights on the part of any contractor or subcontractor in getting any or all of their work done in the proper way, thereby causing cutting, removing and replacing work already in place, shall not be the basis for a claim for extra compensation.

8. If part of the Contractor's work depends for proper execution or results upon construction or operations by the Owner or another contractor, the Contractor shall, prior to proceeding with that portion of its work, promptly report to the Architect and Construction Manager apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall

constitute an acknowledgment that the Owner's or other contractors completed or partially completed construction is fit and proper to receive the Contractor's work.

9. The Contractor shall promptly correct discrepancies or defects in its work which have been identified by other contractors as affecting proper execution and results of the work of such other Contractor.

O. 1. The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities or governmental agencies bearing on performance of the Work. If the Contractor fails to give such notices, it shall be liable for and shall indemnify and hold harmless (a) the Owner, its consultants, employees, officers and agents, (b) the Architect and its consultants, employees, officers and agents, and/or (c) the Construction Manager and its consultants, employees, officers and agents against any resulting fines, penalties, judgments, or damages, including reasonable attorney's fees, imposed on or incurred by the parties indemnified hereunder.

2. The Contractor shall pay any costs or fees incurred in such compliance and any fines or penalties imposed for violation thereof and any costs or fees incurred by the Owner due to such violation. If the Contractor observes that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Architect and Owner in writing, and necessary changes shall be accomplished by appropriate modification to the drawings and/or specifications.

3. If the Contractor performs Work knowing it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Architect, the Construction Manager and Owner, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs and shall bear the total cost for correction of same.

4. If the Contractor fails to give such notices, it shall be liable for and shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, against any resulting fines, penalties, judgments, or damages, including reasonable attorney's fees, imposed on or incurred by the parties indemnified hereunder. The Contractor shall pay any costs or fees incurred in such compliance and any fines or penalties imposed for violation thereof and any costs or fees incurred by the Owner due to such violation.

P. The Contractor recognizes and acknowledges that job meetings will be held at the job site weekly unless otherwise designated by the Owner or the Architect. The Contractor shall have responsible representation at the MANDATORY weekly job meetings held at the Construction Manager's job office. These meetings will be held to arrange for satisfactory coordination of all trades on the project so as not to impede job progress. Contractors or subcontractors failing to attend job meetings shall be responsible for delays and/or expenses incurred due to coordination difficulty.

Q. The Contractor shall provide copies of its daily construction reports to the Construction Manager's Field Superintendent. These reports shall be submitted no later than 10:00 am the following workday. The daily reports shall provide detailed information concerning the Contractor's activities and operations, including work activities on site and manpower. A "Daily Construction" form is included in these specifications and shall be used for reporting these activities. In addition, the Contractors are to submit a Two Week Look Ahead schedule for upcoming work. A "Two Week Look Ahead" form is included in these specifications for the Contractor's use.

#### **ARTICLE 4 CONTRACTOR'S USE OF SITE**

A. The Contractor shall confine operations at the site to the areas at which construction is to be performed and to such areas permitted by law, ordinances, permits and as set forth in detail in the project manual and drawings forming a part of its contract with the Owner.

B. Five (5) days after receipt of the Notice to Proceed, the Contractor shall provide two (2) copies of a videotaped recording of all existing conditions to the Construction Manager. This taping shall provide a record of all existing buildings, grounds, exterior conditions and interior conditions. The Contractor shall schedule a representative of both the Owner and the Construction Manager to be present at this taping. In the absence of this record, the Contractor shall be responsible for paying the costs associated with any and all repairs in an area where the Contractor is working or has worked, as may be deemed necessary by the Owner or the Construction Manager.

C. The occupied portion of any school building shall always comply with the minimum requirements necessary to maintain a certificate of occupancy.

D. General Safety and Security Standards for Construction Projects:

1. All construction materials shall be stored in a safe and secure manner.
2. Fences around construction supplies or debris shall be maintained.
3. Gates shall always be locked unless a worker is in attendance to prevent unauthorized entry.
4. During exterior renovation work, overhead protection shall be provided for any sidewalks or areas immediately beneath the work site or such areas shall be fenced off and provided with warning signs to prevent entry.
5. The Contractor shall exert utmost care and diligence when working in or near any existing buildings or sitework. The absence of protection around such items shall not excuse the Contractor from its liability to provide protection. Any damage to existing buildings, sitework or facilities shall be repaired and charged to the Contractor responsible for the damage.

6. The Contractor shall be responsible for the removal and replacement of existing ceiling tiles and grid in areas of the existing building where its work is required, and new ceilings are not scheduled for installation. In the event that the existing ceilings are damaged and cannot be replaced to the satisfaction of the Owner, the responsible contractor shall be liable for the costs of replacing in kind, the existing ceilings with new tile and grid.

7. All disconnect and/or tie-in work involving any utilities that would interfere with the ongoing operations of the Owner shall be completed after hours when the facility is not in use. The performance of this work shall be projected on all schedules required to be prepared by the Contractor. Additionally, the Contractor shall give the Construction Manager and the Owner at least forty-eight (48) hours advance notice of its intention to perform this type of work. All overtime and standby personnel necessary to complete these tie-ins shall be the responsibility of the Contractor performing the work.

E. 1. Separation of construction areas from occupied spaces: Construction areas which are under the control of a contractor and therefore not occupied by district staff or students shall be separated from occupied areas. Provisions shall be made to prevent the passage of dust and contaminants into occupied parts of the building. Periodic inspection and repairs of the containment barriers must be made to prevent exposure to dust or contaminants. Gypsum board must be used in exit ways or other areas that require fire rated separation. Heavy duty plastic sheeting may be used only for a vapor, fine dust or air infiltration barrier, and shall not be used to separate occupied spaces from construction areas. Methods of dust and fume control shall include, but not be limited to:

- a. Adequate ventilation;
- b. Wetting down;
- c. Keeping bags of insulating materials, cement, etc., closed.
- d. Controlled mixing of materials under field conditions;
- e. Special attention should be utilized in sawing of insulation and certain acoustical materials and storage of materials.
- f. Job housekeeping must be maintained;
- g. Advising all personnel of hazardous conditions, including supervisors and workers;

Each contractor is responsible for instituting the above policies to ensure minimal impact to surrounding occupied areas.

2. A specific stairwell and/or elevator should be assigned for construction worker use during work hours. In general, workers may not use corridors, stairs or elevators designated for students or school staff.

3. Large amounts of debris must be removed by using enclosed chutes or a similar sealed system. There shall be no movement of debris through halls of occupied spaces of the building. No material shall be dropped or thrown outside the walls of the building.

4. All occupied parts of the building affected by renovation activity shall be cleaned at the close of each workday. School buildings occupied during a construction project shall maintain required health, safety and educational capabilities at all times that classes are in session.

F. 1. Storage space will be allotted to the Contractor by the Owner to the extent such space, in the sole discretion of the Owner, is available. The Contractor shall be responsible for securing appropriate space for its material with the Construction Manager prior to delivery. If insufficient space is available on the site, the Contractor shall provide local off-site storage, storage containers, etc. at its own cost and expense. Should any of the material stored on-site obstruct the progress of any portion of the work or the project, this material shall be removed by the Contractor without reimbursement of cost, from place to place or from the premises, as the Construction Manager may direct.

2. The Contractor shall schedule delivery of materials and equipment to minimize long term storage at the Project, to prevent overcrowding of construction spaces, and to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.

3. The Contractor shall deliver materials and equipment to the Project in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installation. The Contractor shall inspect materials and equipment upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected. The Contractor shall store products to allow for inspection and measurement of quantity or counting of units. The Contractor shall store materials in a manner that will not endanger the Project structure. The Contractor shall store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation. The Contractor shall comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

4. The Contractor shall not unreasonably encumber the site with materials or equipment during the performance of its work. Only materials and equipment which are to be used directly in the performance of the Contractor's work shall be brought to and stored on the premises of the School District. After equipment is no longer required for its work, the Contractor shall promptly remove such equipment from the premises of the School District. The Contractor

shall be solely responsible for the protection of construction materials and equipment stored on the premises from weather, theft, damage and all other adversity. The Contractor shall at all times provide the proper housekeeping to minimize potential fire hazards and shall provide approved spark arresters on all steam engines, internal combustion engines and flues.

5. A construction entrance will be designated for deliveries. A separate entrance will be established for entering and exiting the site only. All deliveries shall be scheduled and coordinated with the Construction Manager and the Owner's Security department. Unexpected or uncoordinated deliveries may be turned away by the Owner or the Construction Manager at the discretion or necessity of the Owner. The Owner's enforcement of this provision shall not be construed by any contractor or subcontractor as the basis for a claim of delay in time or monetary damages alleged to have been incurred as a result of refusal of delivery.

6. The Contractor for General Construction shall provide necessary and required security measures to adequately safeguard the construction site from vandalism and intrusion of unauthorized persons. The Contractor for General Construction shall submit its means and methods of security to the Construction Manager for review and comment. The project site(s) must be secured 24 hours a day, 7 days a week including holidays. The General Construction Contractor's failure to secure the site as required by this paragraph will result in the Owner engaging the services of such necessary personnel so as to provide such security. No notice will be given the Contractor for General Construction of the Owner's intention to engage such security services and all costs and expenses associated with the Owner's security of the site in this regard will be back charged to the Contractor for General Construction. While the Owner may have security guards patrolling the project areas, the function of such security guards is not for the purpose of specifically guarding the Contractor's property or operations of work.

G. The Contractor's right to entry and use of the School District premises arises solely from the permission granted by the Owner pursuant to the agreement between the Contractor and the Owner. This permission shall be deemed to be withdrawn upon the termination of the Contractor's agreement with the Owner.

H. 1. The Contractor shall be required to perform its work with no interruption to the School District's operations, including its administrative and business operations. Any work which will interfere with the School District's operations and/or which is to be performed when the School District's facilities are in operation shall be performed on evenings and weekends. Additionally, the Contractor shall conduct its work in compliance with federal, state, county or local ordinances. All costs incurred by the Owner to make the facilities available during evening and weekends shall be borne by the Contractor. The Owner reserves the right to determine what work will "interfere" with its operations and said determination shall be final.

2. The Contractor may request access to the site during times beyond the work hours permitted. Approval is solely at the discretion of the Owner. If approval is given, the Contractor is responsible for paying all additional costs incurred by the Owner, Architect and the Construction Manager for providing the site to the Contractor during the additional time periods.

3. In the event the Contractor fails to complete all work under this contract by said scheduled dates, the Contractor will not be permitted to perform any work during normal school hours. Such work shall only be performed after school hours, Saturdays, Sundays, holidays or periods when school is unoccupied at no additional cost of any kind to the Owner. In addition to damages incurred by the Owner in connection with the Contractor's delay, the Contractor shall be liable for all costs incurred by the Owner to provide staff, Architect and Construction Manager personnel as required to make facility accessible by Contractor and perform inspections during such off hours.

4. The Owner shall not be responsible for any overtime charges incurred by the Contractor during the course of this project. Any and all costs associated with work which is performed at hours requiring the payment of such overtime by the Contractor to its workers shall be the Contractor's responsibility.

I. Construction and maintenance operations shall not produce noise in excess of 60 dba in occupied spaces or shall be scheduled for times when the building or affected building spaces are not occupied or acoustical abatement measures shall be taken.

J. The Contractor shall provide all required temporary access walkways, both interior and exterior, and the like necessary to complete its work. The Contractor shall maintain an unobstructed condition at all entrances and/or exits from present buildings. No equipment, other than equipment with rubber tires, will be allowed on any existing or new pavement, UNLESS THE CONTRACTOR HAS OBTAINED THE PRIOR APPROVAL OF THE CONSTRUCTION MANAGER AND THE PAVEMENT HAS BEEN FIRST PROTECTED WITH PLANKING OR BY OTHER MEANS APPROVED BY THE CONSTRUCTION MANAGER.

K. The Contractor and any entity for whom the Contractor is responsible shall not erect any sign on the premises of the School District without the prior written consent of the Owner, which consent may be withheld at the sole discretion of the Owner.

L. 1. Without the prior approval of the Owner, the Contractor shall not permit any workers to use any existing School District facilities, including, without limitation, lavatories, toilets, entrances and parking areas other than those designated by the Owner. Employees, vehicles, and equipment of the Contractor and of all others engaged by the Contractor for the performance of its work shall enter onto the premises of the School District for which construction work is to be performed only at those locations designated or approved by the Construction Manager. The parking for construction personnel shall be limited to the designated trailer park area only. Failure to abide by this rule will result in towing of cars at the expense of the contractor who employs the individual.

2. The Contractor shall ensure that its work, at all times, is performed in a manner that affords reasonable access to both vehicles and individuals, to the premises of the School District and all adjacent areas. The Contractors' work shall be performed, to the fullest extent possible, in such a manner that areas in and around the construction area shall be free from all debris, building materials and equipment likely to cause hazardous conditions, and do not close

or obstruct walkways, roadways or other occupied facilities or facilities to be used by the Owner. Without limitation to any other provision of the agreement between the Contractor and the Owner, the Contractor shall use its best efforts to minimize any interference with the occupancy of areas, buildings, entrances, and parking areas in and around the premises at which work is being performed. Free access to fire hydrants and standpipe connections shall be maintained at all times during construction operations, and portable fire extinguishers shall be provided by the Contractor and made conveniently available throughout the construction site.

3. The Construction Manager, in conjunction with the Owner and the Architect, shall designate locations at the site at which the Contractor, its subcontractors and employees may utilize in connection with its work. The Contractor's employees and the employees of the Contractor's Subcontractors and others engaged by the Contractor to perform its work are prohibited from trespassing or leaving any vehicle on any property not assigned by the Owner as set aside for the use of the Contractor. The Contractor's employees and the employees of the Contractor's Subcontractors and other engaged by the Contractor to perform its work are restricted to the immediate area at which work is to be performed. Only persons having official business will be admitted to the construction site. NO COMMUNICATION BETWEEN THE CONTRACTOR, ITS EMPLOYEES, SUBCONTRACTORS' EMPLOYEES, OR OTHERS ENGAGED BY THE CONTRACTOR FOR THE PERFORMANCE OF ITS WORK AND STUDENTS OR STAFF WILL BE PERMITTED.

4. The Contractor, its employees, its Subcontractors and their employees or agents, and all others engaged by the Contractor in connection with the performance of its work are required to wear photographic identification badges at all times. The Contractor shall provide such individuals with said photographic identification badges. These badges shall be worn so as to be readily and easily visible. All workers and representatives of the Contractor, its subcontractors or suppliers shall wear these badges while on school property. The information on these badges shall be as prescribed by the Owner and the Construction Manager. Each person seen without a photo identification badge (or otherwise failing to comply with this requirement in the opinion of the Owner or the Construction Manager) shall be ordered to leave school property. No warnings shall be necessary. The Contractor(s) and their subcontractor(s) employing the offending person(s) shall be solely responsible for making-up and paying for any loss of production or required progress in the Work resulting from this action (including any claims by other Contractors dependent on the work of this Contractor). All parties agree that any action taken to enforce this requirement shall not be construed by any Contractor or its subcontractors or suppliers as the basis for a claim (for either time or money) for delay to the Work or to the Contractor, its Subcontractors, or Suppliers.

5. Without limitation of any other provision of the agreement between the Owner and Contractor, the Contractor shall use its best efforts to comply with all rules and regulations promulgated by the Owner in connection with the use and occupancy of the premises of the School District. The Contractor shall immediately notify the Owner in writing if during the performance of its work, the Contractor finds compliance with any portion of such rules and regulations to be impracticable, setting forth the problems of such compliance and suggesting alternative through which the same results intended by such portion of the rules and regulations



can be achieved. The Owner may, in the Owner's sole discretion, adopt such suggestions, develop new alternatives or require compliance with the existing requirements of the rules and regulations.

M. No drinking of alcoholic beverages, smoking or use of controlled substances is permitted on the grounds. The Contractor shall insure that none of its or its Subcontractors, its employees, agents, and/or consultant's report to the site impaired by alcohol or controlled substances. The Contractor bears the responsibility of determining if its, or its subcontractors, employees are in any way impaired and whether the safety of the public, the employees of other Contractors and their Subcontractors, the Owner, Architect, or Construction Manager are jeopardized. Each contractor shall provide drinking water for its own employees.

N. The Contractor's employees, representatives, agents and consultants, and all of its Subcontractors' employees, representatives, agents and consultants at the site are to refrain from using indecent language. All doing so will be removed from the site. Artwork or decoration found on vehicles belonging to Contractor or Subcontractor employees parked on or near the school property which contain indecent language or pictures shall either be covered or removed from the location.

O. The Contractor's employees, representative, agents and consultants, and all of its Subcontractors' employees, representatives, agents and consultants at the site are to wear shirts, long pants and proper footwear.

P. Each contractor shall keep the premises and surrounding area in which it is working free from accumulation of waste materials or rubbish caused by the performance of all of the work being performed on-site and in the buildings. On a daily basis at the conclusion of work on the project, each contractor shall clean the areas in which it has performed work and shall remove all waste, materials, rubbish, its tools, construction equipment, machinery and surplus materials. Each Contractor shall broom sweep all construction areas in which it has performed worked every day. The Construction Manager shall perform an inspection each afternoon to determine that the work areas of the contractors have been properly cleaned. In the event the work areas are not cleaned, the Construction Manager shall advise the offending contractor to provide cleaning as required herein. If any contractor fails to keep the site safe and clean within four (4) hours of being notified by the Construction Manager, either verbally or in writing, the Construction Manager will have the cleanup work performed and back charged to the offending contractor without further notification to the Contractor. The cost of such cleaning company, together with the cost of any custodial costs of the School District, at prevailing overtime rates plus 15% will be charged to the offending contractor. Notice to field personnel shall be deemed notice to the Contractor.

Q. The Contractor shall provide ventilation of enclosed areas during construction as may be required to permit proper curing and drying out and to prevent excessive humidity, moisture and condensation. Ventilation shall be by natural or artificial means as required by conditions involved.

R. The Contractor shall be responsible for the control of chemical fumes, gases and other contaminants produced by welding, gasoline or diesel engines, roofing, paving, painting, etc. to ensure that they do not enter occupied portions of the building or air intakes.

S. The Contractor shall be responsible for ensuring that activities and materials which result in "off-gassing" of volatile organic compounds such as glues, paints, furniture, carpeting, wall covering, drapery, etc. are scheduled, cured or ventilated in accordance with manufacturers' recommendations before a space can be occupied.

T. From the commencement to the completion of the Project, the Contractor shall keep the parts of the work and the buildings free from accumulation of water no matter what the source or cause of water.

U. 1. The General Contractor shall construct temporary partitions where shown on drawings or where otherwise required for safety of the public or to prevent dust from entering occupied areas. Partitions shall be dust-proof from floor to slab or structure above (if existing condition is a drop in tile ceiling, Contractor shall remove tile and install partition to structure above). In addition to framing and sheetrock, the Contractor shall install fire resistant plastic partitions on the work area side of its work. If an access door is required, an alternating 3 layer plastic system shall be used. The door shall be a standard hollow metal door with lockset and closer. Keys shall be distributed to the Owner's other contractors, the Owner and the Architect.

2. All cutting and welding performed within an occupied building or adjacent to a window or intake vent shall be performed during off hours.

V. 1. The Contractor shall control the safe handling and storage of all welding materials, acetylene and oxygen tanks, and other equipment required for welding and cutting work at the job site. Such storage shall be in compliance with OSHA regulations.

2. Welding materials and equipment shall be removed promptly from the premises upon completion of the welding and cutting work.

W. The Contractor shall be responsible for all costs incurred by the Owner caused by false security/fire alarms set off by the Contractor. Costs shall include custodial response charges etc.

X. The Contractor shall be responsible for broken glass, and at the completion of the Work shall replace such damaged or broken glass. After damaged or broken glass has been replaced, the Contractor shall remove all labels, wash and polish both sides of all glass. In addition to general broom cleaning, the General Contractor shall perform the following final cleaning for all trades at completion of the Work:

1. Remove temporary protections;
2. Remove marks, stains, fingerprints and other soil or dirt from painted, decorated and natural finished woodwork and other Work;

3. Remove spots, plaster, soil and paint from ceramic tile, marble and other finished materials, and wash or wipe clean;
4. Clean fixtures, cabinet work and equipment, removing stains, paint, dirt and dust, and leave same in undamaged, new condition;
5. Clean aluminum in accordance with recommendations of the manufacturer; and
6. Clean all floors thoroughly in accordance with recommendations of the manufacturer.

Y. Where a contractor other than the General Contractor is the only contractor engaged to perform work, the responsibilities allocated to the General Contractor in these General Conditions shall be performed by such other contractor.

## **ARTICLE 5 SUBCONTRACTORS**

A. 1. As soon as practicable after receipt of Letter of Intent to Award, Notice to Proceed or other form of official notice of award of the Contract, but not more than ten (10) days after receipt of official notice of award of the Contract, the Contractor shall furnish the Owner and the Architect, in writing, with (1) the name, trade and subcontract amount for each Subcontractor and (2) the names of all persons or entities proposed as manufacturers of the products identified in the Specifications (including those who are to furnish materials or equipment fabricated to a special design) and, where applicable, the name of the installing Subcontractor. Copies of all Subcontractor contracts, fully executed, are to be provided to the Construction Manager, including but not limited to all addenda, appendices, and/or exhibits including scope of work sheets. All such subcontracts shall be submitted to the Construction Manager within ten (10) days of the Owner's award of the contract to the Contractor.

2. Upon review of the Contractor's list of Subcontractors, the Architect will advise the Contractor in writing stating whether or not the Owner, the Construction Manager or the Architect, after due investigation, accepts or rejects, any proposed Subcontractor. Subcontractors will not be acceptable unless, when requested by the Architect, evidence is furnished that the proposed subcontractor has satisfactorily completed similar subcontracts as contemplated under this prime contract, and has the necessary experience, personnel, equipment, plant, and financial ability to complete the subcontract in accordance with the intent to the Documents. As verification of financial ability, the Owner reserves the right to request and receive up to five (5) years' worth of financial statements, bank references, bond/insurance company references and all other information required to assess financial ability.

3. If the Owner, Construction Manager or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner, Construction Manager and Architect have no objection. No increase in the Contract Sum shall be allowed where a sub-contractor is rejected by the Architect, Construction Manager or Owner who is (1) deemed unqualified to perform the particular work subcontracted by the Contractor, (2) does not have the necessary experience, personnel, equipment, plant and financial ability to complete the subcontract, or (3) has a history of poor performance in work of similar

nature. Upon receipt of a rejection of a subcontractor by the Architect, the Contractor shall have the right to request a meeting with the Architect, Construction Manager and the Owner to discuss the reasons it believes the subcontractor is qualified to perform the work. Upon review of such reasons, the Architect shall re-consider its determination and shall advise the Contractor of its determination upon such review. If the Architect still finds that such subcontractor does not meet the requirements above-stated, it shall advise the Contractor. The Architect's determination upon such review shall be final and binding on the Contractor and its Subcontractor and the Contractor hereby waives any and all claims it or its subcontractor might have against the Owner, the Construction Manager and/or the Architect concerning the rejection of such Contractor and shall require its subcontractors to execute such similar waiver in its agreement with the Contractor.

4. The Contractor shall not change a Subcontractor, person or entity previously selected if the Owner, Construction Manager or Architect makes reasonable objection to such change.

B. By appropriate agreement, the Contractor shall require each Subcontractor to be bound to the Contractor by terms of the Contractor's agreement with the Owner, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by said agreement, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner, Construction Manager and Architect under the Contractor's agreement with the Owner so that subcontracting thereof will not prejudice such rights, and shall allow the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by its agreement with the Owner, has against the Owner. However, the Subcontract agreement between the Contractor and Subcontractor shall not provide, nor shall this Agreement be deemed to provide any rights, remedies or redress by the Subcontractor(s) against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors.

C. The Contractor shall promptly notify the Owner, Construction Manager and Architect of any material defaults by any Subcontractors and/or whether it has terminated its agreement with any of its subcontractors for any reason.

D. The Contractor hereby assigns all of its rights in its agreements with its Subcontractor(s) and hereby does assign, transfer and set over to the Owner all of its rights and/or interests in its agreements with its Subcontractor(s), but only in the event of termination of the Contractor's agreement with the Owner pursuant to Article 17, paragraph A of these General Conditions of the Contract for Construction and only to the extent the Owner implements its rights to take such assignment of contract by notifying the Subcontractor in writing of its intention to do so. Such an assignment is subject to the prior rights of the surety, if any, obligated to the Owner pursuant to a performance bond submitted in connection with the Contractor's work.

E. If the Work in connection with a subcontract has been suspended for more than ninety (90) days after termination of the Contract by the Owner and the Owner accepts assignment of

such subcontract, the Subcontractor's compensation shall not be adjusted for any increase in direct costs incurred by such Subcontractor as a result of the suspension.

F. It shall be the Contractor's responsibility, when sub-contracting any portion of his work, to arrange or group items of work under particular trades to conform with them prevailing customs of the trade, regardless of the particular Divisions and Sections of the Specifications in which the work is described.

G. All subcontracts must be in writing.

## **ARTICLE 6**

### **CONTRACTOR'S USE OF DRAWINGS/SPECIFICATIONS**

A. The Agreement between the Owner and Contractor, and all documents incorporated therein by reference, including but not limited to, the drawings and project manual shall be signed by the Contractor and the Owner.

B. The intent of the agreement between the Owner and the Contractor is to include all items necessary for the proper execution and completion of the work to be performed by the Contractor. The documents comprising the agreement between the Contractor and the Owner are complementary, and what is required by one shall be as binding as if required by all.

C. 1. In the event of inconsistencies within or between parts of the agreement between the Contractor and the Owner or between the agreement between the Contractor and the Owner and applicable standards, codes and ordinances, the Contractor shall (a) provide the better quality or greater quantity of Work or (b) comply with the more stringent requirement; either or both in accordance with the Architect's interpretation.

2. On the Drawings, given dimensions shall take precedence over scaled measurements and large scale drawings over small scale drawings.

3. Before ordering any materials or performing any of its work, the Contractor and each Subcontractor shall verify measurements at the Project site and shall be responsible for the correctness of such measurements. No extra charge or compensation will be allowed on account of differences between actual dimensions and the dimensions indicated on the Drawings. Any difference which may be found shall be submitted to the Architect for resolution before proceeding with the performance of the work.

4. If a minor change in the Work is found necessary due to actual field conditions, the Contractor shall submit detailed drawings of such departure for the approval by the Architect before making the change.

5. Drawings, in general, are made to scale, but all working dimensions shall be taken from the figured dimensions or by actual measurements at the job and in no case by scaling. The Contractor shall study and compare all Drawings and verify all figures before laying out or

constructing the work and shall be responsible for any and all errors in his work which might have been avoided thereby. Whether or not an error is believed to exist, deviation from the Drawings and the dimensions given thereon shall be made only after approval in writing is obtained from the Architect.

6. In the event addendum (a) are issued and contain changes to the Drawings and/or Specifications, the provisions in the addendum (a) supersede previously issued Drawings and/or Specifications.

D. Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control Contractor in dividing the work among Subcontractor or in establishing the extent of Work to be performed by any trade.

E. Unless otherwise stated in the agreement, words and abbreviations which have well-known technical or construction industry meanings are used in the agreements in accordance with such recognized meanings.

F. The Contractor, and all Subcontractors, shall refer to all of the Drawings, including those showing the work of others performing work in connection with the project, including but not limited to the General Contractor (if any), the Plumbing Contractor, the Heating, Ventilation, Air Conditioning Contractor, Electrical Contractor and other specialized trades, and to all of the Divisions of the Project Manual, and shall perform all work reasonably inferable therefrom as being necessary to produce the indicated results.

G. All indications or notations on the drawings which apply to one of a number of similar situations, materials or processes shall be deemed to apply to all such situations, materials or processes wherever they appear in the Work, except where a contrary result is clearly indicated by the drawings or project manual. All work mentioned or indicated in the drawings or project manual shall be performed by the Contractor unless it is specifically indicated therein that the work is to be performed by others.

H. The Drawings, Specifications and other documents prepared by the Architect are instruments of the Architect's service through which the Contractor's work is to be performed. The Contractor may retain one contract record set during the course of the project. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect, and unless otherwise indicated the Architect shall be deemed the author of them and will retain all common law, statutory and other reserved rights, in addition to the copyright. All copies of them, except the Contractor's record set, shall be returned or suitably accounted for to the Architect, on request, upon completion of the Work.

I. The Drawings, Specifications and other documents prepared by the Architect, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects without the specific written consent of the Owner and Architect. The

Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect appropriate to and for use in the performance of its work pursuant to its agreement with the Owner. All copies made under this license shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Architect. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's copyright or other reserved rights.

J. The Owner shall furnish surveys describing physical characteristics of the site, upon written request of the Contractor and to the extent such survey is in existence at the time of said request, legal limitations and utility locations for the project sites. Nothing herein shall be construed as requiring the Owner to generate any document which it does not possess at the time of the request by the Contractor. In the event that the survey provided does not clearly delineate the metes and bounds of the Owner's property, the Contractor shall stop work and immediately notify the Architect, Construction Manager and the Owner. The Contractor shall NOT proceed with its work until it receives written permission from the Construction Manager and/or the Architect. The Contractor shall be fully responsible for all costs arising from non-compliance with this provision. Any delays associated with this provision shall not serve as a basis for a claim by the Contractor.

K. From the basic data established by the Owner, the General Contractor shall establish reference control points and complete the layout of the work. Each Contractor is responsible for utility mark-outs as it pertains to the scope of their work and maintain mark-out during work. Sketch of layout with reference points to be given to Construction Manager and Architect at the time of mark-out.

L. The Contractor shall be responsible for all measurements that may be required for execution of the work to the exact position and elevation as prescribed in the specifications, shown on the drawings, or as the same may be modified at the direction of the Architect to meet changed conditions.

M. The General Contractor shall be responsible for the establishment of points, wall and partition lines required by the various Prime Contractors and subcontractors in laying out their work.

N. Each Contractor shall furnish such stakes and other required equipment, tools and materials, and all labor as may be required in laying out any part of the work from the base lines and benchmarks established by the Owner.

O. 1. The General Construction Contractor shall establish a baseline and benchmark system for each building addition, area of renovation or component using the services of a licensed professional surveyor. The surveyor(s) employed to establish this system or to extend and maintain an existing benchmark system for the work of other trades shall have not less than five years of experience in performing construction surveys similar to the work they will perform

for this project. The remaining Contractors and their respective subcontractors shall be responsible for extending these lines, levels and grades, and for performing all layout for their own work. The Contractor is solely responsible for any damage or loss due to incorrect extension of lines, level or grades in their layout. The Contractor and its subcontractors shall be responsible for the accuracy with respect to the layout of their work. Any discrepancies or errors in the drawings, perceived by another contractor or subcontractor shall be immediately reported to the Construction Manager. If any corrections are necessary, they shall be executed in accordance with the terms and provisions of these General Conditions.

2. The Contractor and its subcontractors shall be responsible to offset or to protect their markings from anything that may disturb them.

3. Every contractor shall work off the lines and elevations established and maintained as the baseline and benchmark system.

4. Each Contractor is responsible for the accuracy of his own work.

P. The Architect may require that construction work be suspended at any time when location and limit marks established by the Contractor are not reasonably adequate to permit checking completed work or the work in progress.

Q. Except for the basic building permit, the Contractor shall be responsible for securing and maintaining for the life of the project: all permits, P.E. Licenses, connection fees, inspections, etc. applicable to, or customarily secured for the work. This provision includes any permits to be issued in the name of the Contractor required for the work. Originals of all permits are to be issued in the name of the Contractor as required for the work. The Contractor shall furnish the Construction Manager with original copies of all permits prior to the commencement of the work and shall prominently display a copy of all permits at a location approved by the Construction Manager.

R. The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Architect at once.

S. The exactness of grades, elevations, dimensions, or locations given on any Drawings issued by the Architect, or the work installed by other contracts, is not guaranteed by the Architect or the Owner. The Contractor shall, therefore, satisfy itself as to the accuracy of all grades, elevations, dimensions, utilities and locations. In all cases of interconnection of its Work with existing or other work, it shall verify at the site all dimensions relating to such existing or other work. Any errors due to the Contractor's failure to so verify all such grades, elevations, locations or dimensions shall be promptly rectified by the Contractor without any additional cost to the Owner.



T. 1. The Contractor shall give the Architect timely notice of any additional design drawings, specifications, or instructions required to define its work in greater detail, or to permit the proper progress of its work. To the extent the Architect advises the Contractor that the existing design drawings, specifications and/or instructions given are sufficiently detailed for the Contractor to perform its work, the Architect shall be under no obligation to further clarify or define the work to be performed. In all other circumstances, the Architect shall issue a field order which responds to the request for information.

2. Requests for Information (RFIs) are for requests on clarifications or questions on contract drawings and specifications, not contract terms, scheduling items, or general correspondence, nor, as a means to describe or request approval of alternate construction means, methods or concepts or substitution of materials, systems means and methods. The Contractor shall fill all RFIs out in accordance with the provisions of the Project Manual. Neither the Architect nor the Construction Manager shall fill said forms out on the Contractor's behalf.

U. The Contractor shall, prior to the start of any portion of the Work:

1. review any specified construction or installation procedures, including those as may be recommended by the proposed manufacturer.
2. advise the Architect if the specified procedure(s) deviates from good construction practice.
3. advise the Architect if following said procedure(s) will affect any warranty, including the contractor's general warranty.
4. advise the Architect of any objections the Contractor may have to the specified procedure(s).
5. propose any alternative procedure(s) which the Contractor will warrant.

V. 1. To the fullest extent possible, the Contractor shall provide products of the same kind, from a single source. When two or more items of same material or equipment are required (pumps, valves, air conditioning units, etc.), they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in the work, except as otherwise indicated. The Contractor shall provide products which are compatible within systems and other connected items. If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

2. The Contractor is responsible for providing products and construction methods

compatible with products and construction methods of other contractors. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

3. With respect to sitework materials, all products submitted for use and incorporated into this project shall be on the Approved List of Materials and Equipment published by the NYSDOT Materials Bureau, most recent edition.

4. All products submitted for use and incorporated into this project shall be asbestos free.

W. Equivalents. In the Specifications, one or more kinds, types, brands, or manufacturers or materials are regarded as the required standard of quality and are presumed to be equal. The Contractor may select one of these items or, if the contractor desires to use any kind type, brand, or manufacturer or material other than those named in the specifications, they shall indicate in writing, and prior to award of contract, what kind, type, brand or manufacturer is included in the base bid for the specified item. The Contractor shall follow the submission requirements for substitutions as set forth in Article 6.X below.

X. 1. Substitutions. If the Contractor desires to substitute any kind, type, brand, or manufacturer of material other than those named in the Specifications, the Contractor shall indicate the desired substitution in its bid, including the following:

a. For which specified material or equipment the request for substitution is being made;

b. What kind, type, brand, or manufacturer is sought to be substituted for the specified items;

c. Written documentation evidencing that the substituted material or equipment meets or exceeds the specifications for materials and/or equipment set forth in the project manual. Such documentation shall include, but not limited to, a full explanation of the proposed substitution, together with a submittal of all supporting data including technical information, catalog cuts, warranties, test results, installation instructions, operating procedures, significant qualities of proposed substitution (e.g. performance, weight, size, durability and visual effects), and other like information necessary for a complete evaluation of the substitution. Additionally, the Contractor shall provide material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated. All such data shall be provided to the Architect and Owner at the Contractor's sole expense. The Contractor's written explanation shall also include a list of reasons the substitution is advantageous and necessary, including the benefits to the Owner and the project in the event the substitution is acceptable. Additionally, the Contractor shall submit to the Architect information describing in specific detail how the proposed substituted product differs from the

quality and performance required by the base specifications, and such other information as may be required by the Owner or the Architect.

d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

e. Samples, where applicable or requested.

f. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.

g. Detailed comparison of the difference in cost between the specified product and the proposed substitution including any and all costs associated with changes or modifications needed to other parts of the work and to construction performed by the Owner and/or separate Contractors that will be necessary to accommodate proposed substitution. In the event the substitution is accepted, the Contractor proposing the use of the substitution shall bear all costs associated with said changes or modifications.

2. By making said requests in conformance with procedures established herein and elsewhere in the Project Manual, the Contractor:

a. Represents that a representative of it has personally investigated the proposed substitute product and has determined that it is equal to or superior in all respects to that specified.

b. Represents that the warranty for the substitution will be the same, or greater than, that applicable to the specified product.

c. Certifies that the cost data is complete and includes all related costs under this contract, including professional services necessary and/or required for the architect and engineers to implement said substitution and waives any and all claims for additional costs related to the substitution which subsequently become apparent.

d. Represents that it will coordinate the installation of the accepted substitute, making all such changes to the drawings effected by the change, including but not limited to the electrical, plumbing, site work and heating and ventilating specifications as may be required for the work to be complete in all respects.

e. An affidavit stating that (1) the proposed substitution conforms and meets all the requirements of the pertinent Specifications and the requirements shown on the Drawings and (2) the Contractor accepts the warranty and correction obligations in connection with the proposed substitution as if originally specified by the Architect; and the proposed substitution will have no effect on the construction schedule.

3. Proposals for substitutions shall be submitted with the Contractor's bid.

4. No substitutions will be considered or allowed without the Contractor's submittal of complete substantiating data and information as stated hereinbefore.

Y. 1. Submittal of shop drawings, product data, material safety data sheets, samples or similar submittals shall be in accordance with the provisions of the project manual.

2. The Contractor represents and warrants that all shop drawings have been prepared by persons and entities possessing expertise and experience in the trade for which the shop drawing is prepared and, if required by the Architect or applicable law, by a licensed engineer, job specific, reviewed by Contractor and stamped by the Contractor.

3. If the Contractor elects to perform its work without approvals, such work shall be at the Contractor's own risk and expense.

4. By approving and submitting shop drawings, product data, samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto and has checked and coordinated the information contained within such submittals with the requirements of its work.

5. The Contractor shall not be relieved of responsibility for deviations from requirements of its work by the Architect's approval of shop drawings, product data, samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and the Architect has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors and/or omissions in the shop drawings, product data, samples or other of its submittals to the Architect, by the Architect's approval thereof.

6. The Architect shall review, approve, reject or take other appropriate action respecting submittals made by the Contractor as set forth in the Project Manual. The Architect shall check for conformance with information given in the drawings and project manual and the design concept expressed in the agreement between the Owner and the Contractor. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities or for substantiating instructions for installation or performance of equipment or systems designed by the Contractor, all of which remain the responsibility of the Contractor. Further, the Architect's review shall not constitute

approval of safety precautions or, unless otherwise specifically stated by the Architect, of construction means, methods, techniques, sequences or procedures.

The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component. When professional certification of performance characteristics of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon such certification to establish that the materials, systems or equipment will meet the performance criteria required by the Contract Documents.

7. Upon the Architect's rejection of the Contractor's shop drawings, product data, samples and/or other documentation submitted by the Contractor to the Architect, the Contractor shall review the rejection and re-submit such shop drawing, product data, sample and or other document in accordance with the Architect's instruction. The Contractor shall direct the Architect's specific attention in writing or on re-submitted shop drawings, product data, samples, or similar submittals, to revision which have been made, including revisions not specifically requested by the Architect. Resubmission of rejected documents shall be performed within ten (10) calendar days. No claim for delay or cost shall be accepted as a result of rejected documents.

8. When professional certification of performance criteria of materials, systems or equipment is required of the Contractor, the Architect shall be entitled to rely in a reasonable and professional fashion upon the accuracy and completeness of such calculations and certifications provided, however, if the Architect, in its reasonable and professional judgment considers it advisable, the Architect shall verify the accuracy and completeness of any and all such calculations and/or certifications. In the event any and all such calculations and/or certifications are found to be inaccurate and/or incomplete by the Architect, the Contractor shall assume full responsibility and bear all costs attributable or related thereto, including, without limitation, the expense of the Architect's additional services associated with the verification of such calculations and/or certifications and the expense of the Architect's additional service made necessary by the failure of such calculations and/or certifications to be accurate or complete.

9. If the Architect is required to review the Contractor's submittal more than twice, the Contractor shall bear the cost and expense associated with such additional review as set forth in the Project Manual.

Z. The Architect will interpret and decide matters concerning performance under and requirements of the drawings and/or technical specifications on written request of the Contractor. Such interpretations may, at the Architect's option, be issued in the form of additional drawings or instructions indicating in greater detail the construction or design of the various parts of the Contractor's work. Such drawings or instructions may be forwarded by the Architect to the Contractor by field order, construction change directive or other notice to the Contractor. The Contractor shall execute the work for which it requested an interpretation in accordance with such additional drawings or instructions without additional cost or extension of its contract time. After a decision has been rendered by the Architect on a matter for which the Contractor sought the Architect's interpretation of the drawings and/or technical specifications, the Contractor shall proceed with the work as directed by the Architect. Failure to proceed with the work in

accordance with the Architect's interpretation may be used as a basis for termination of the Contractor's contract pursuant to Article 17 of these General Conditions.

AA. The Contractor shall maintain at the site one record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record changes and selections made during construction, and in addition approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and the Construction Manager and shall be delivered to the Construction Manager for submittal to the Owner upon the completion of its work.

BB. The Contractor shall maintain at the site, and shall make available to the Owner, Construction Manager and Architect, one record copy of the Drawings (the "Record Drawings") in good order. The Record Drawings shall be prepared and updated during the prosecution of the Contractor's work. The prints for Record Drawing use will be a set of black line prints provided by the Architect to the Contractor at the start of construction. The Contractor shall maintain said set in good condition and shall use colored pencils to mark-up said set with "record information" in a legible manner to show: (i) deviations from the Drawings made during construction; (ii) details in the work not previously shown; (iii) changes to existing conditions or existing conditions found to differ from those shown on any existing drawings; (iv) the actual installed position of equipment, piping, conduits, light switches, electric fixtures, circuiting, ducts, dampers, access panels, control valves, drains, openings, and stub-outs, etc.; (v) architectural and/or structural changes in the design; and (vi) such other information as either Owner or Architect may reasonably request. At the completion of the work, Contractor shall transfer all information on record drawings to reproducible drawings with new information clouded and noted. Such drawings shall be stamped with the Contractor's name and "AS-BUILT" in the lower righthand corner. The colored record drawing and the as-built reproducible drawing shall be forwarded to the Construction Manager for delivery to the Owner. Final payment and any retainage shall not be due and owing to Contractor until the Record and/or As Built drawings receive the approval from the Architect and the Owner (and all other closeout requirements are met).

CC. The Contractor shall maintain all approved permit drawings in a manner so as to make them accessible to government inspectors and other authorized agencies. All approved drawings shall be wrapped, marked and delivered to the Owner within sixty (60) days of final completion of the Contractor's work.

DD. Each Prime Contractor shall be furnished, free of charge, 3 copies of the Contract Documents and Project Manuals, including all Addenda. Any and all additional copies will be furnished to the Contractor at the cost of reproduction, postage and handling.

## **ARTICLE 7 CONTRACTOR'S SAFETY/SECURITY PROGRAM**

A. 1. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of its work.

Prior to beginning any work, the contractor shall submit a copy of its corporate safety plan to the Owner and the Architect. Two (2) weeks after receipt of the Notice to Proceed, the Contractor shall provide a Site Safety/Logistics Plan to the Owner and the Architect. The site logistics plan should minimally include locations of the eight-foot high temporary fence and gates, traffic plans for deliveries and removals, refuse container locations, crane locations, pick locations, boom radius, and lift locations, stockpiles, toilet locations, site water and power locations, and safety. This plan shall also show the location of all staging and storage areas, clearly separating construction and school areas. The logistical information represented by the construction documents shall serve as a minimal guide. Each contractor is required to submit their corporate safety policy within ten (10) days of receipt of the Notice to Proceed. Said policy must minimally meet OSHA standards and define details concerning the maintenance of a safe work environment and shall also define practices for the maintenance of hygiene and minimizing the spread of infectious/contagious diseases. The Contractor shall make the participation of its subcontractors in its safety program mandatory. A list of key personnel, with addresses and telephone numbers for emergency purposes shall be forwarded to the Owner and the Architect. The Owner and the Architect shall establish a fire coordination procedure and shall forward same to the Contractor for its use during the performance of its work.

2. All laborers, workers, and mechanics employed in the performance of the work of this Project shall be certified as having successfully completed a course in construction safety and health approved by the United States Department of Labor's Occupational Safety and Health Administration that is at least ten (10) hours in duration.

The Contractor and its subcontractors shall conduct their operation in accordance with the Safety Guides for Construction as issued by the SED, and, the Contractors' Safety Program.

3. All safety equipment including hard hats and weather protective gear required for the Contractor to perform its work are to be supplied by the Contractor and/or its subcontractors. Within the designated construction areas, the Contractor's employees, superintendents, and/or other agents, and its subcontractors, employees, superintendents, and/or other agents are required to wear hard hats and other required and/or essential safety equipment. Each person seen without a hard hat, or otherwise failing to comply with this requirement, will be ordered to leave the project. No prior warnings will be given by the Owner or Construction Manager and Architect. The Contractor and its subcontractors shall be solely responsible for making up and paying for any loss of production or required progress resulting from the removal of personnel from the project as set forth herein including any costs incurred by the Owner in connection with the work of other contractors.

4. The Contractor and its subcontractors shall provide blankets and auxiliary fire protection as part of its construction safety program to prevent damage to adjacent work or materials as a result of its welding or burning operations. Additionally, as part of its construction safety program, the Contractor and its subcontractors shall provide a fire watch, with a fire extinguisher, which is acceptable to the Owner and the Construction Manager.

5. The Construction Manager and/or Owner reserve the right to have all operating equipment periodically inspected by an independent inspector whose finding will be binding. The Prime Contractor, at its own expense, must make corrections within two (2) working days of receiving a written report.

6. All flagmen required for deliveries to the site are to be furnished by the Contractor or its Subcontractors responsible for the delivery. Any and all deliveries crossing the site or student traffic areas shall be escorted by flagmen. All flagmen shall wear orange vests.

B. The Contractor shall schedule weekly safety meetings and each of its subcontractors must be properly represented at such meetings. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. The Contractor shall notify the Construction Manager in writing its "OSHA Competent Person Regarding Safety". Said person must be an individual capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Construction Manager and Architect. The Contractor shall take all necessary steps to prevent its employees from disturbing and/or damaging the facility and shall be responsible for preventing the escape of fires set in connection with the construction. The Contractor shall notify its employees and subcontractors of the location of the nearest fire alarm box at all locations where the work is in progress. On a weekly basis, the Contractor shall submit to the Construction Manager and Architect minutes of its safety meetings, which minutes shall include a list of the individuals present at such meetings.

C. The Contractor and each of its subcontractors shall conduct its/their operation in accordance with all applicable laws, regulations and order of local, state and federal governments. The Contractor agrees, in order that the work will be completed with the greatest degree of safety to conform to the requirements of the Occupational Safety and Health Act of 1970 (OSHA) and the Construction Safety Act of 1969, including all standards and regulations that have been since or shall be promulgated by the governmental authorities which administer such acts.

D. The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

E. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for surety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

F. The Contractor shall take reasonable precautions for the safety and protection of employees at the project site and other person who may be affected by its work, including but



not limited to students, staff, employees and agents of the Owner, the Construction Manager and the Architect.

G. The Contractor shall protect and secure its work and the materials and/or equipment to be utilized in connection with its work, whether stored on or off the site and whether in its care, custody and control or that of its Subcontractors, subcontractors to its subcontractors, or material suppliers.

H. The Contractor shall take all steps necessary to protect all property at or adjacent to the site, including but not limited to trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

I. All delivery vehicles/trucks/machinery/etc. permitted on the site must be equipped with back-up alarms and enter through the designated access points. The Contractor's failure to demonstrate this ability will result in cancellation of delivery or stoppage of work. All delays associated with this cancellation will be the responsibility of the contractor responsible for the work involved.

J. All crane picks, materials delivery, etc. must be coordinated so as not to lift over any occupied area of the building. If absolutely necessary, this work shall be done on off hours to ensure the safety of the building occupants. Crane location must be approved by the Construction Manager to ensure the safety of building occupants.

K. The Owner or Construction Manager reserves the right to have all hoisting equipment periodically inspected by an independent inspector whose findings will be binding. The Contractor, at its own expense, must make corrections cited by the inspector before continuing work. The Owner or Construction Manager will not assume any responsibility for the safe operation of any hoisting equipment by exercising this right. The Contractor and/or its subcontractor(s) shall cooperate with the inspector by allowing time for the inspection. The Contractor shall be notified twenty-four (24) hours prior to the time of the inspection. These inspections do not release the Contractor of its responsibility to provide all engineering, permits and inspections as required by OSHA or the New York State Education Department prior to use of any hoisting equipment.

L. The Contractor shall use the entrances designated on the site logistic plans and drawings for personal vehicles, trucks, equipment, deliveries and the like.

M. All interior temporary partitions and emergency egress barriers (if required) are to be installed on an after hours basis (weekends/school holidays).

N. 1. When use or storage of hazardous materials or equipment or unusual construction methods are necessary to perform its Work, the Contractor shall obtain the Owner and the Construction Manager's consent for the use of such materials, equipment or unusual construction methods. In the event the Owner determines that the use of such hazardous material or equipment or unusual construction methods can be performed by the Contractor with alternative

means, methods and/or techniques, the Contractor shall employ such alternate means of prosecuting its work at no additional cost to the Owner.

2. In the event the Owner approves the use or storage of such hazardous materials, equipment or unusual construction methods, the Contractor shall provide for the Owner's and the Construction Manager's use a full set of safety instructions relating to all such materials. Additionally, when the Owner and/or the Construction Manager reviews the use of storage of such hazardous materials, equipment and or unusual construction methods, the Contractor shall exercise the highest degree of care and carry on such activities under supervision of properly qualified personnel.

3. Transportation, storage, and use of explosives shall be in strict accordance with all local, state and federal regulations, statutes, and requirements. All safety precautions as set forth in the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America, Inc. shall be observed.

4. The Contractor is responsible for its own storage and personnel trailers at the site. The Contractor will be required to supply man trailers and storage box trailers as required. All costs related to delivery, construction, protection, power, etc. for said trailers are the responsibility of the contractor utilizing the space. The Owner WILL NOT PROVIDE STORAGE SPACE. The placement of personnel and/or storage trailer will be strictly limited to pre-determined locations. The Contractor shall obtain the written approval of the placement of any trailer or storage box from the Construction Manager.

O. During construction, the General Contractor shall be responsible for maintaining a watertight structure. This shall include additions and existing buildings. The contractor shall be responsible for temporary roofing, tarps and other protection at roofs, cavity walls, etc. Should the contractor fail to provide adequate protection, causing flooding, damage or other disturbance to the existing building, contractor shall be responsible for all costs associated with clean up and repairs. Inasmuch as flooding and damage have safety implications to the general public, clean up and repairs may be made by the Owner without warning to the Contractor. Administration costs incurred by the Owner and Architect will also be back charged to the Contractor. The Contractor, by entering into contract with the Owner agrees to be liable for these costs.

P. When all or a portion of the Contractor's work is suspended for any reason, the Contractor shall securely fasten down all coverings and protect the work, as necessary, from injury by any cause.

Q. 1. The Contractor shall promptly remedy damage and loss to all property of the Owner, or adjacent to the Owner's property (other than damage or loss covered by insurance) caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor.

2. Title to all completed or partially completed work at the job site, and to all materials delivered to and stored at said job site which are intended to become a part of the completed work covered by the agreement between the Contractor and the Owner, shall be in the name of the Owner. Notwithstanding the foregoing, and prior to acceptance of the completed work by the Owner, the Contractor shall be liable for all loss of or damage to said completed work, partially completed work, materials furnished by the Contractor, and/or materials or equipment furnished by others, the custody of which has been given to the Contractor, arising from any cause other than those against which the Owner herein undertakes to carry insurance. In the event of loss or damage from cause other than those against which the Owner undertakes to carry insurance, the Contractor shall replace or repair the said work or materials at his own cost and expense, to the complete satisfaction of the Owner, the Construction Manager and the Architect.

R. The Contractor shall promptly report in writing to the Owner, the Architect and the Construction Manager all accidents arising out of or in connection with the Work which cause death, person injury, or property damage, giving full details and statements or any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately by telephone or messenger to the Owner, Construction Manager and the Architect.

S. In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss.

T. Any and all fines or citations levied against the Owner, Architect, or Construction Manager due to the failure of the Contractor to comply with regulations of any governing authority, shall be paid for by the Contractor. This shall include any interest or late charges which accrue due to the Contractor's failure to remit payment upon receipt of such levies.

U. The Contractor shall indemnify and hold harmless the Owner, Construction Manager and Architect from any and all claims, damages, losses, suits, obligations, fines, penalties, costs, charges and expenses which may be imposed upon or incurred by or asserted against any of them by reason of any act or omission of such Contractor or any subcontractor or any person or firm directly or indirectly or indirectly employed by such Contractor, with respect to violations of OSHA requirements, rules and/or regulations.

V. The Contractor acknowledges that the Labor Law of the State of New York, and regulations adopted thereunder, place upon both the Owner and Contractor certain duties and that liability for failure to comply therewith is imposed on both the Owner and Contractor regardless of their respective fault. The Contractor hereby agrees that, as between the Owner and the Contractor, and to the extent permitted by law, the Contractor is solely responsible for compliance with all such laws and regulations imposed for the protection of persons performing the Contract.

W. The Contractor shall indemnify and hold harmless the Owner, Architect, and Construction Manager, of and from any and all liability for violation of such laws and regulations and shall defend any claims or actions which may be brought against the Owner as the result thereof. In the event that the Contractor shall fail to refuse to defend any such action, the Contractor shall be liable to the Owner for all costs of the Owner, Architect or Construction Manager in defending such claim or action and all costs of the Owner, including attorney's fees, in recovering such defense costs from the Contractor.

X. The Contractor and its subcontractors shall indemnify and hold harmless the Owner, Construction Manager and Architect from any and all claims, damages, losses, suits, obligations, fines, penalties, costs, charges and expenses which may be imposed upon or incurred by or asserted against any of them by reason of any act or omission of such Contractor or any subcontractor or any person or firm directly or indirectly employed by such Contractor, for the act and/or omissions of any Contractor or Subcontractor that resulted in an incident and/or accident causing personal injury and/or property damage.

Y. The Construction Manager, the Owner, and/or the Architect will not assume any responsibility for the safe operation of any cranes or equipment by exercising this right. The Contractor and its subcontractors shall cooperate with the inspector by allowing time for inspection. The Contractor will be notified 24 hours prior to the time of the actual inspection. The Contractor is obligated to perform all engineering, obtain permits, and to have all hoisting equipment inspected as required by OSHA, Village, Town, County, State, and Federal regulations as well as any other agency having jurisdiction. Copies of all inspection reports and certificates must be transmitted to Construction Manager as soon as possible.

## **ARTICLE 8 CHANGES IN THE WORK**

A. Without invalidating the agreement between the Owner and the Contractor, and without notice to the Contractor's surety, the Owner may, at any time or from time to time, order additions, deletions or revisions in the Contractor's work. Such additions, deletions or revisions will be authorized by field order, change order, or construction change directive.

B. Field Orders are an interpretation of the contract drawings and/or specifications which order minor changes in the Contractor's work which will not result in an increase or decrease in the Contractor's total contract sum. From time to time, the Architect may issue field orders to the Contractor. The work included in such field order shall be performed by the Contractor at no additional cost to the Owner and shall not form the basis for a claim for an extension of time of the Contractor's time to complete its work. Hence, the Contractor shall perform the work included in field orders so as to cause no delay to its work and/or the work of other contractors engaged by the Owner in connection with the project. All field orders shall be given to the Contractor and the Construction Manager by the Architect in writing.

C. 1. When the Owner or Architect (in association with the Construction Manager) request that the Contractor perform work which is not included in the contract drawings or

specifications and which will result in additional cost to the Owner, the Architect/Construction Manager shall issue a PCO Number and shall request that the Contractor submit its proposal for performing such additional work. The Contractor shall submit its proposal to the Construction Manager and Architect for review. The Contractor's proposal shall include a complete itemization of the costs associated with performing its work including labor and materials. All proposals for any work that a Contractor, its subcontractor(s) or subcontractor(s) of subcontractor(s) perform in connection with additional work shall be submitted using the following format and in no event shall the total for overhead and profit on any change order exceed fifteen percent (15%) of the cost of the work.

1.	Materials (Itemized Breakdown) including quantities and cost	
2.	Labor (Itemized Breakdown)	
3.	Subtotal (Add lines 1 and 2)	
4.	Credit for work not required due to additional or changes to the work reflected in the within change order (if any)	
5.	Overhead (10% x line 3)	
6.	Subtotal (Add lines 3 through 5)	
7.	Sub-Contract Work (Include itemized breakdown. Sub-Contractor(s) overhead and profit allowed is 10%)	
8.	Subtotal (Add lines 6 and 7)	
9.	Profit (5% x line 8)	
10.	Subtotal (Add lines 8 and 9)	
11.	Rental Value of Equipment (Itemized Breakdown)	
12.	Actual additional charges for bonds	
13.	TOTAL CHANGE ORDER (Add lines 10, 11 and 12)	

2. All proposals submitted by the Contractor without the itemization indicated herein will be returned to the Contractor for re-submission by the Contractor. For any work performed by the Contractor's own forces, fifteen percent (15%) for overhead and profit will be allowed for labor and material related costs. Costs to which overhead is to be applied shall be limited to cost of labor and materials including the cost of delivery. Under no circumstances shall any change order proposal exceed fifteen percent (15%) of the cost of overhead and profit.

The Contractor shall not be entitled to recover overhead and profit on the rental value of equipment and machinery. "Equipment and machinery" shall not include (1) tools customarily used by the contractor's trade, including but not limited to hand tools, and/or (2) equipment and machinery already on site and being utilized by the Contractor for the original scope of work.

The Contractor shall submit with its change order proposals actual invoices from its insurance broker reflecting actual additional costs associated with the procurement of bonds.

3. The Contractor's subcontractor's proposal for any work it is to perform in connection with the additional work shall only include ten percent (10%) for the subcontractor's

overhead and profit including sub-subcontracted work. The Contractor is entitled to five percent (5%) on work performed by its subcontractor in accordance with paragraph C (1) of this Article 8. Costs to which overhead is to be applied shall be limited to cost of labor and materials including the cost of delivery. Under no circumstances shall the Contractor or the Contractor's subcontractor(s) be entitled to be reimbursed for overtime, except when specifically approved by the Owner in writing and not as an Extraordinary Measure as set forth in Article 13, and in such event the Contractor shall be paid for by the Owner on the basis of premium payment.

4. Notwithstanding the foregoing, work which is performed pursuant to an allowance included in the Contractor's base contract, the provisions of Article 9, paragraph B, concerning itemization of such work shall be controlling.

5. a. A change in the Contract Sum shall be accomplished only by a written Change Order. Accordingly, no course of conduct or dealings between the parties, nor express or implied acceptance of alterations or additions to the Work, whether or not there is, in fact, any unjust enrichment to the Work, shall be the basis of any claim as defined in Article 18 of these General Conditions to an increase in any amounts due under the Contract Documents or a change in any time period provided for in the Contract Documents. **No amount shall be payable by the Owner to the Contractor for performance of work without a written and fully executed Change Order.**

b. Upon the Contractor's completion of the change order work, and prior to payment being made to the Contractor for such work, the Contractor shall provide the Owner with the following information:

1. Certified payrolls itemizing the labor actually utilized in connection with the change order work.
2. Copies of invoices from subcontractors supplying work in connection with the change order work.

D. 1. When the Owner or Architect request that portions of the Contractor's work originally included in the contract drawings or specifications be deleted and which will result in a reduction of the Contractor's original contract sum, the Architect shall request that the Contractor submit its proposal for deleting the scope of such work from its contract. The Contractor's proposal shall include a complete itemization of the costs associated with deducting such work including labor and materials and shall be submitted using the format set forth in Article 8, paragraph C(1) of these General Conditions of the Contract for Construction or the schedule of values, whichever is greater. The Contractor shall not be entitled to retain its overhead and/or profit for such work nor shall any of its subcontractors which were to perform the work being deducted from the Contractor's scope of work. Additionally, the Contractor shall reflect the reduced cost of premiums on bonds which are to be supplied herein as a result of such change. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase/decrease with respect to that change.

2. The Owner may in its sole discretion deduct and/or reduce the scope of the Contractor's contract with or without any specific reasons therefor.

E. 1. In the event the Contractor and the Owner cannot agree on the sum by which its contract with the Owner is to be increased or reduced based upon changes to the scope of the work as described in Article 8, the Architect shall issue a construction change directive reflecting the deduction and/or reduction of the scope of the Contractor's contract and the Contractor will (a) in the case of additional work to be performed by the Contractor, perform such additional work in an expeditious manner so as not to delay the work of this or other contractors working at the site, and (b) in the case of work to be deducted from the scope of the Contractor's work, refrain from taking any steps in connection with the work associated with the deduction and/or reduction of the scope of the Contractor's work. The construction change directive shall include (a) a description of the work being added or deducted from the Contractor's scope of work; (b) the amount the Owner has determined to be the cost associated with the additional work or deduction and/or reduction of the scope of the Contractor's contract until the Owner and the Contractor agree upon the increase or decrease in the Contractor's contract sum, or until a claim filed by the Contractor has been determined; (c) the extent to which the contract time will be adjusted as a result of the change in the scope of work. Any claims must be filed in accordance with the requirements set forth in Article 18 of these General Conditions. Failure to timely file any claim in accordance with requirements set forth therein shall constitute a waiver of such claim.

2. In the event the Contractor and the Owner reach agreement on the amount by which the Contractor's contract sum is to be increased or decreased based upon changes to the scope of the Contractor's work as described in Article 8, the Architect, Owner, Construction Manager and Contractor shall sign a change order reflecting such agreement. The change order shall include (a) the description of the change in the scope of the Contractor's work; (b) the amount of the adjustment to the Contractor's contract sum, if any; and (c) the length of time by which the time to complete the contract will be adjusted, if any. Agreement between the Owner and the Contractor in connection with any change order shall constitute a final settlement of all matters relating to the change in the Contractor's work as reflected in said change order, including but not limited to, all direct and indirect costs associated with such change and any and all adjustments to the Contractor's contract sum and the construction schedule. All such change orders for which the Owner and the Contractor have reached agreement shall be included as a separate line item in the Contractor's applications for payment as if originally part of the Contractor's agreement with the Owner.

F. Neither the Owner, the Construction Manager nor Architect may issue instructions to the Contractor to change the amount of the Contract, except by properly executed Change Orders. Instructions are issued by the Owner or the Construction Manager through the Architect, to the Contractor. The instructions shall not be carried out by the Contractor prior to a written order in the form of a Change Order, signed by the Owner, Architect and Contractor, authorizing a change in the Contract amount or an adjustment to the Contract Sum. No amount shall be payable by the Owner to the Contractor for performance of work without an executed Change Order.

## **ARTICLE 9 PAYMENTS**

A. 1. Prior to commencing its work on the project and within one (1) week of receipt of a Notice to Proceed, the Contractor shall submit to the Construction Manager and the Architect, a schedule of values which includes the amount of money it has allocated in its bid price for the following items of work which are applicable to the Contractor's work. Said schedule of values shall include each of the CSI division sections reflected in the specifications and applicable to the contract for which the Contractor has been awarded the contract, together with the requirements for bonds/insurance (based upon actual invoice amount), general conditions, meeting attendance and meeting documentation (at least two (2) percent of the contract sum), shop drawing/product data/sample submissions (at least one (1) percent of contract sum), labor and materials on line items as applicable, temporary utilities and services, HVAC balance reports, coordination drawings, punch list (at least one (1) percent of the contract sum), warranties/guarantees and close out of the project (at least three (3) percent of the contract sum), and allowance, where applicable.

2. Any schedule of values which fails to include sufficient detail, is unbalanced or exhibits "front loading" of the value of the Contractor's work will be rejected. Furthermore, if the schedule of values has been approved by the Construction Manager and the Architect and is subsequently used, but later is found by the Construction Manager or Architect to be improper for any reason, sufficient funds shall be withheld from the Contractors' future applications for payment to ensure an adequate reserve (exclusive of normal retainage) to complete the Contractor's work.

3. The schedule of values shall be drafted so as to reflect multiple construction sites, multiple locations within each site, additions versus renovations of work, and the like so as to satisfy any New York State Education Department requirements for the project.

4. The Schedule of Values prepared by the Contractor must be approved by the Construction Manager and the Architect prior to the payment of any sums due the Contractor.

B. The Contractor shall include in its contract sum all allowances stated in the specifications. However, the Contractor's costs for unloading and handling at the site, overhead, profit and other expenses contemplated for the stated allowance amounts shall be included in its contract sum and not in the allowances.

C. The Contractor shall submit its applications for payment to the Construction Manager and the Architect on a periodic basis. The form to be used by the Contractor shall be AIA 702/CMA and 703/CMA approved by the Construction Manager, the Architect and the Owner for use in connection with the Contractor's work. The form shall be divided in sufficiently in the same form as the Contractor's schedule of values and shall reflect in separate line items for the work:

1. Total value of the work listing labor and material separately



2. Percentage of work completed at the time of submission of the application for payment
3. Value of the work completed at the time of submission of the application for payment
4. Percent of previous amount billed
5. Previous amount billed
6. Current percent completed
7. Value of work completed to date
8. Percent remaining to be completed by the Contractor; and
9. Value of work remaining to be completed by the Contractor

D. 1. Payments to the Contractor shall be based upon materials and equipment delivered and suitably stored at the site and/or incorporated into the Contractor's work, together with the labor utilized by the Contractor in connection with its work. The Contractor may be paid for materials and/or equipment which has been delivered to the Owner's facilities but which, at the time of submission of its application for payment, has not yet been incorporated into the Contractor's work upon such conditions and requirements as the Owner, the Construction Manager and/or the Architect may advise the Contractor it must satisfy.

2. The Construction Manager and Architect shall review the application for payment submitted by the Contractor and shall advise the Contractor of any adjustments to be made thereto. The Construction Manager and/or the Architect may make such adjustments under the following circumstances:

- a. the Contractor's failure to remedy defective work;
- b. the filing of third party claims or reasonable evidence that there is a probability that such claims will be filed;
- c. receipt by the Owner of a notice of withholding from the New York State Department of Labor or other administrative agencies having jurisdiction over the project;
- d. the Contractor's failure to make proper payments to its subcontractors or material suppliers for labor, materials and/or equipment;
- e. reasonable evidence that the Contractor will not complete its work for the unpaid balance of the remaining monies on its contract;
- f. damages caused to the Owner, Construction Manager, the Architect or another contractor as a result of the Contractor's performance of its work;
- g. reasonable evidence that the Contractor will not complete its work in accordance with its agreement with the Owner, and/or that the remaining monies available on the Contractor's contract will not be sufficient to cover actual or liquidated damages for the anticipated delay;

- h. the Contractor's failure to carry out its work in accordance with the contract drawings and/or specifications;
- i. the Contractor's failure to notify the Architect of errors or inconsistencies between and among the contract drawings and specifications;
- j. the Contractor's and/or its subcontractors' failure to comply with the requirements for maintaining record drawings;
- k. the Architect's and/or the Construction Manager's discovery or observation of work which has been previously paid for by the Owner which is defective and/or incomplete;
- l. such other acts and/or omissions by the Contractor in connection with the performance of its work.
- m. The amount requested exceeds the percent completion of work on the site.

3. After any such adjustments are made to the Contractor's application for payment, the Contractor shall submit four (4) copies of the final draft of its application for payment to the Construction Manager and Architect, which shall be accompanied by the following documentation:

- a. A current Contractor's lien waiver and duly executed and acknowledged sworn statement showing all Subcontractors and material suppliers with whom the Contractor has entered into subcontracts, the amount of each such subcontract, the amount requested for any Subcontractor and material suppliers in the requested progress payment and the amount to be paid to the Contractor from such progress payment, together with similar sworn statements from all such Subcontractors and material suppliers;
- b. Duly executed waivers of public improvement liens from all Subcontractors and material suppliers and lower tiered Subcontractors or material suppliers establishing payment or satisfaction of payment of all amounts requested by the Contractor on behalf of such entities or persons in any previous Application for Payment; and AIA Form G706 or G706A.
- c. Certified payroll for employees of the Contractor and employees of subcontractors performing work on the Project.
- d. Copies of invoices submitted to the Contractor by its subcontractors and/or material suppliers.
- e. Such other information which the Owner, Construction Manager and/or

the Architect request the Contractor furnish in connection with its application for payment, including but not limited to, contractor change order log, contractor submittal log and as built drawings to date.

4. Upon submission of its application for payment, the Contractor represents that it is entitled to payment in the amount for which it seeks payment.

5. In addition to the right to make adjustments to the amount the Contractor claims is due it (as set forth in paragraph 3 of this paragraph (2), the Owner may withhold payment from the Contractor and the Architect and/or Construction Manager may withhold certification for payment, if any of the reasons set forth in paragraph 3 exist.

6. The Owner shall make payment to the Contractor within forty-five days of receipt of the Contractor's requisition of payment unless such requisition of payment is not in accordance with the terms of the Construction Documents.

7. Upon receipt of payment by the Owner, the Contractor shall promptly make payment to each of its subcontractors and/or material suppliers for which it has received payment from the Owner. This provision does not obligate the Architect, the Construction Manager and/or the Owner to ensure payment to the Contractor's subcontractors and/or material suppliers.

8. a. In the event a subcontractor and/or material supplier files with the Owner a public improvement lien, the Owner shall withhold payment on previously certified applications for payment which have not yet been paid or subsequent applications for payment submitted by the Contractor an amount equal to 150% of the amount set forth in such public improvement lien. This provision is in addition to and does not supersede the indemnity provisions set forth in Article 12 of these General Conditions.

b. The Owner may release any payment withheld due to the filing of a public improvement lien if the Contractor obtains security acceptable to the Owner or a lien bond which is: (1) issued by a surety acceptable to the Owner, (2) in form and substance satisfactory to the Owner, and (3) in an amount not less the 150% of such lien claim. The cost of the premiums for any such bond posted shall be borne solely by the Contractor. By posting a lien bond or other acceptable security, however, the Contractor shall not be relieved of its obligations pursuant to these General Conditions, including but not limited to the indemnity provisions set forth in Article 12 of these General Conditions.

E. 1. The Contractor shall not be entitled to payment for materials and/or equipment stored off the site unless previously approved in writing by the Owner, Architect, and/or the Construction Manager and upon the Contractor meeting any and all conditions which the Owner, the Architect and/or Construction Manager may impose in connection with such materials and/or equipment, including but not limited to insurance for such materials and cost of storage and transportation associated with such materials and/or equipment. No payment will be made for "commodity type" stored materials such as block, studs, sheetrock, roofing, insulation, piping,

fittings, conduit work, etc.

2. In connection with materials and/or equipment stored off the project site, the Contractor must submit with its application for payment the following information:

- a. Type of material must be specifically identified by the Contractor;
- b. The Contractor must furnish an invoice from its supplier showing the total value of material and/or equipment being stored off site and must provide the bill of lading for such material and/or equipment;
- c. The Contractor must provide a Certificate of Insurance in a form approved by the Owner for the full value of the item plus 10%.
- d. The Contractor must execute a security agreement, together with an executed UCC-1 form;
- e. The materials must be stored in a bonded warehouse;
- f. The Contractor must furnish a bill of sale for stored material and/or equipment;

Contractor still has liability for all materials whether paid or not until installed.

3. Any and all materials and/or equipment for which the Contractor has been paid shall be titled in the Owner upon installation by the Contractor and shall be stored in a bonded facility. For payment to be made to the Contractor, the Contractor must provide the Owner with a waiver of lien and general release from its supplier in connection with its provisions of such materials and/or equipment. Notwithstanding payment by the Owner, any and all warranties and/or guarantees required by this agreement shall not begin to run until the Contractor has completed all of its work.

4. Prior to payment by the Owner, the Contractor may be required to provide the Architect and the Construction Manager with an opportunity to visually inspect the materials and/or equipment for the purpose of determining that such materials are in fact in storage, are the materials specified for the Contractor's work and for any other purpose which the Owner, Construction Manager and/or Architect deem necessary for payment to be made to the Contractor.

F. If the Owner is entitled to reimbursement or payment from the Contractor under or pursuant to its agreement with the Owner, including but not limited to these General Conditions of the Contract for Construction, such payment shall be made promptly upon demand by the Owner. Notwithstanding anything contained herein to the contrary, if the Contractor fails to promptly make any payment due the Owner, or the Owner incurs any costs and expenses to cure any default of the Contractor or to correct defective work, the Owner shall have an absolute right

to offset such amount against the Contract Sum and may, in the Owner's sole discretion, elect either to: (1) deduct an amount equal to that which the Owner is entitled from any payment then or thereafter due the Contractor from the Owner, or (2) issue a written notice to the Contractor reducing the Contractor's contract sum by an amount equal to that which the Owner is entitled.

G. The Contractor may not assign any monies due or to become due to it pursuant to its agreement with the Owner without the Owner's written consent. Any such assignment shall be in a form acceptable to the Owner. If the Contractor attempts to make such an assignment without such consent from the Owner, the Contractor shall nevertheless remain legally responsible for all obligations under its agreement with the Owner.

H. Progress payments and all other payments shall be made in accordance with Section 106 (b) of the General Municipal Law.

I. At the same time the Contractor submits its insurance certificate to the Owner and the Construction Manager, it shall also submit to the Construction Manager the labor rates of each category of labor for which it and/or its subcontractors shall employ (either directly or indirectly).

This information shall be itemized in the format shown below:

Contractor's Name					
Contractor's Address					
Contractor's Office Phone					
Contractor's Fax Number					
Contractor's Email Address					
<b>Labor Rate Breakdown</b>					
Worker's Title		<b>Journeyman</b>	<b>1.5 Rate</b>	<b>Foreman</b>	<b>1.5 Rate</b>
Base Hourly Rate					
<b>Payroll Tax &amp; Insurance:</b>	<b>\$ Per Hr.</b>				
FICA					
Federal					
Unemployment					
State					
Workers Compensation					
Disability					
Other (Explanation Required)					
<b>Subtotal</b>					

<b>Benefits:</b>	<b>\$ Per Hr</b>				
Vacation					
Health & Welfare					
Pension					
Annuity					
401K Fund					
Other (Explanation Required)					
Other Explanation Required)					
<b>Subtotal</b>					
<b>Hourly Labor Rate</b>					

## ARTICLE 10

### RESERVED

## ARTICLE 11

### MT. PLEASANT CSD INSURANCE AND BOND REQUIREMENTS

#### 11.1 Contractor's Liability Insurance

11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

1. Claims under workers' compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed, including private entities performing Work at the site and exempt from the coverage on account of number of employees or occupation, which entitles shall maintain voluntary compensation coverage at the same limits specified for mandatory coverage for the duration of the Project. As required by the New York State Workers' Compensation Law, all out of state contractors working in New York must provide a Workers' Compensation

Insurance Policy that specifically lists New York in Item 3A of the Policy Information page;

2. Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees, or persons or entities excluded by statute from the Requirements of Clause 11.1.1.1 but required by the Contract Documents to provide

**the insurance required by the Clause;**

3. **Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;**
4. **Claims for damages insured by usual personal injury liability coverage;**
5. **Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;**
6. **Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle; and**
7. **Claims for bodily injury or property damage arising out of completed operations; and**
8. **Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18, including omissions and supervisory acts by the Owner.**
9. **Liability Insurance shall include all major divisions of coverage and be on a comprehensive basis. The required coverage shall be written on an occurrence basis and shall include the following:**
  1. **Premises Operations (including X, C, and U coverage's as applicable).**
  2. **Independent Contractor's Protective.**
  3. **Products and Completed Operations.**
  4. **Contractual, including specified provision for Contractor's obligation under Paragraph 3.18 of the General Conditions.**
  5. **Owned, non-owned and hired motor vehicles.**
  6. **Broad Form Property Damage including Completed Operations.**
  7. **Personal Injury Liability.**
10. **All insurance policies (excluding workers' compensation) shall name the Owner, Architect and their consultants and Construction Manager as additional insureds. In addition, the insurance policies required to be purchased and maintained by the Contractor under this Agreement shall be: (i) written on an occurrence basis, and (ii) shall be primary on a per project basis for the defense and indemnification of any action or claim asserted against the Owner, Architect, Construction Manager and/or the Contractor for work performed under this agreement regardless of any other collectible insurance or any language in the insurance policies that may be to the contrary. The policies of the Owner, Architect, Construction Manager and their consultants shall be excess and noncontributory.**
11. **If the General Liability coverages are provided by a Commercial Liability Policy on a claims-made basis, the policy date or Retroactive Date shall predate the Contract; the termination date of the policy or applicable extended reporting period shall be no earlier than the termination date of coverages required to be maintained after final payment, certified in accordance with Subparagraph 9.10.2, but in no event earlier than**

two (2) years from the final completion of the Project.

11.1.2 Unless otherwise provided in the Contract Documents, the Contractor and each of its Subcontractors shall purchase and maintain the insurance required by this Contract in the amounts as identified herein below and elsewhere in the Contract Documents. Such insurance shall be written for not less than any limits of liability required by law or those set forth in the Contract Documents, whichever is greater. All insurance shall be written on an occurrence basis. Coverage shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment. A copy of the additional insured endorsement shall be attached.

11.1.2.1 Contractor's insurance requirements shall be provided by an insurance carrier licensed to do business in the State of New York and have an A.M. Best Rating of A(-) or better as determine in the most recent A.M. Best Publication, or as may otherwise be required by the bid documents. The insurance required by this Article 11 shall be obtained by the Contractor and written for not less than the limits of liability set forth below or required by law, whichever coverage is greater. Coverages shall be maintained without interruption from the date of commencement of the Work until the date of Final Payment and termination of any coverage required to be maintained after Final Payment.

***Workers Compensation:***

**Statutory New York**

**Employer's Liability:**

**Each Accident: \$1,000,000.00 Disease, Policy**

**Limit: \$1,000,000.00**

**Disease, Each Employee: \$1,000,000.00**

***Commercial General Liability and Umbrella Liability:***

**(Coverage: - Occurrence, using ISO Form CG 00 01 07 98 or later form)**

***Limits per Project:***

**Each Occurrence: \$6,000,000.00**

**General Aggregate (per Project): \$7,000,000.00 Products -**

**Complete/Operations: \$7,000,000.00 Personal & Advertising**

**Injury: \$6,000,000.00**

**Fire Damage (any one fire): \$50,000.00 Medical Expense**

**(any one person): \$10,000.00**



**Limits for Employers Liability, Commercial General Liability and Automobile Liability may be satisfied by the use of an Umbrella.**

***Automobile Liability:*** (Coverage - must include coverage for liability for all vehicles (owned, leased, hired and non-owned automobiles)

***Limits:*** \$2,000,000.00 (each occurrence)

***Disability Benefits:*** (Coverage - will be provided during the life of the Agreement for the benefit of such employees that are required to be insured by the applicable provisions of law).

***Riggers Liability:*** If the scope of Work involves rigging, hoisting, lowering, raising or moving of property or equipment not belonging to the Contractor. Riggers Liability Insurance is required to insure for the full value of the property or equipment against physical damage/loss.

***Owner's Contractor's Policy:***

**(OCP Named Insured to include: Owner)**

***Limits:***

**\$2,000,000.00 (each occurrence)**

**Aggregate Limit, Bodily Injury and Property Damage: \$2,000,000.00**

**11.1.2.2 Additional Insureds:** All insurance coverage to be provided by the Contractor and Subcontractors, with the exception of the Workers' Compensation, shall name the parties listed below as Additional Insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations and completed operations. Additional insured status shall be provided by ISO endorsement CG 20 10 11 85 or equivalent.

- 1. the Owner's Board of Education;**
- 2. Members of the Owner's Board of Education, an officer, member of its staff or employee of said Board of Education, and the successors, assigns, affiliates, partners, agents, heirs, and personal representatives of each of the foregoing;**
- 3. Architects and its Consultants;**
- 4. Construction Manager; and**
- 5. Additional individuals and entities as the Owner may so name.**

**11.1.2.2.2 Additionally,** the insurance coverage to be provided by the Contractor pursuant to this Article 11 shall state that the Contractor's coverage shall apply as Primary and Non-Contributing Insurance before any other insurance or self-insurance, including any deductible, maintained by, or provided to, the additional insured.

**11.1.2.3 In the event that any of the insurance coverage to be provided by the Contractor to the**

Owner contains a deductible or self-insured retention, the Contractor shall indemnify and hold the Owner, Architect and Construction Manager harmless from the payment of such deductible, which deductible shall in all circumstances remain the sole obligation and expense of the Contractor.

**11.1.2.4 Contractor and all its Subcontractors shall maintain Completes Operations coverage for itself and each additional insured for at least two (2) year after completion of the Work.**

**11.1.3 Certificates of insurance acceptable to the Owner shall be submitted to the Construction Manager for transmittal to the Owner with a copy to the Architect prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. The Owner retains the right to request copies of actual policies and endorsements to verify coverage. These certificates and the insurance policies required by this Article 11 shall contain a provision that coverages afforded under the policies will not be allowed to be materially changed or canceled or allowed to expire until at least thirty (30) days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage shall be furnished by the Contractor with reasonable promptness.**

**11.1.4 Subcontractor's Insurance: Except as otherwise approved in writing by Owner, Contractor shall cause each of the Subcontractors and Sub-subcontractors to procure and to maintain during the life of its Subcontract or Sub-Subcontract, insurance of the types and in the amounts required of Contractor and reasonable to the Owner. The Owner and the Architect, its Consultants, Construction Manager and all other designated entities will be added as additional insureds on a primary and non-contributing basis to the fullest extent permitted by law for all claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations which will also include completed operations for a period of not less than two (2) years after substantial completion. In the event the Contractor fails to obtain the required certificates of insurance from Subcontractor and a Claim is made or suffered, the Contractor shall indemnify, defend, and hold harmless the Owner, Architect, Construction Manager, Owner's Representative, Consultants, Sub-consultants and their agents or employees from any and all Claims for which the required insurance would have provided coverage. This indemnity obligation is in addition to any other indemnity obligation provided in the Contract.**

**11.1.5 The Contractor acknowledges that its failure to obtain or keep current the insurance coverage required by Article 11 shall constitute a material breach of contract and subjects the Contractor to liability for damages, including but not limited to direct, indirect, consequential, special and such other damages the Owner sustains as a result of such breach. In addition, the Contractor shall be responsible for the indemnification to the Owner of any and all costs associated with such lapse in coverage, including but not limited to reasonable attorneys' fees.**

**11.1.6 The Contractor assumes responsibility for all injury or destruction of the Contractor's materials, tools, machinery, equipment, appliances, shoring, scaffolding, and personal property of Contractor's employees from whatever cause arises. Any policy of insurance secured covering the**

Contractor or Subcontractor leased or hired by them and any policy of insurance covering the Contractor or Subcontractors against physical loss or damage to such property shall include an endorsement waiving the right of subrogation against the Owner, Architect and Construction Manager for any loss or damage to such property.

11.1.7 The amount of insurance required by the Construction Documents shall not be construed to be a limitation of the liability of on the part of the Contractor or any of its Subcontractors.

11.1.8 Unless otherwise specified in the Contract Documents, Contractor may maintain Excess/Umbrella insurance, providing excess coverage over all limits for Employers Liability, Commercial General Liability and Automobile Liability to satisfy the limits required in 11.1.2.1.

11.1.9 At the same time the Contractor submits its Insurance Certificate it shall also submit to the Architect the labor rates for each category of labor for which it or its Subcontractors shall employ (either directly or indirectly). This information shall be itemized in a format required by the Architect.

#### 11.1.10 Asbestos/Lead Abatement Insurance

With coverage for the services rendered to the Owner, including but not limited to removal, replacement, enclosure, encapsulation and/or disposal of asbestos, or any other hazardous material, along with any related pollution events, including coverage for third party liability claims for bodily injury, property damage and cleanup costs: \$1,000,000 per occurrence; \$2,000,000.00 products and completed operations aggregate and \$2,000,000.00 General Aggregate. If retroactive date is used, it must pre-date the inception of the Contract.

11.1.10.1 In addition, the contractors Pollution Liability policy shall also include coverage for non-owned disposal site liability, Mold Remediation and Related Expenses.

11.1.11 If automobiles are to be used for transporting hazardous materials, the Contractor shall provide pollution liability broadened coverage (ISO endorsement CA 9948) as well as proof of MCS 09.

#### 11.1.12 Rigging Liability

If the scope of work involves rigging, hoisting, lowering, raising or moving of property or equipment not belonging to the Contractor, Rigging Liability Insurance is required for the full value of the property or equipment against physical damage/loss.

#### 11.2 Owner's Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

#### 11.3 Property Insurance

11.3.1 The Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all risk" or equivalent policy form in the amount of the initial Contract Sum, plus

value of subsequent Contract modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for the Architect's, Contractor's, and Construction Manager's services and expenses required as a result of such insured loss. The form of policy for this coverage shall be Completed Value. Notwithstanding the definition of the "Work" in this Contract or in this Section 11.3.1.1, the Contractor assumes all responsibility for the safety and keeping of all tools and equipment and any materials or products used to complete or perform the Work, and which do not form a permanent part of the Work. The Contractor waives all rights against the Owner and Architect, their consultants, sub-consultants, employees and agents for any loss or damages to any such tools, equipment or any material or products used to complete or perform the Work, and which do not form a part of the Work. The Contractor shall require similar waivers in favor of the above named parties from all Subcontractors and Sub- subcontractors, agents and employees of any of them.

11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

11.3.1.3 If the property insurance requires deductibles, the Contractor shall pay costs not covered because of such deductibles.

11.3.1.4 The Contractor shall provide insurance coverage for portions of the Work stored off the site, in transit, and stored on the site but not incorporated into the Work on a full replacement cost basis. The Contractor is responsible for all deductible amounts.

11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take

reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

**11.3.1.6** The insurance required by Section 11.3 is not intended to cover machinery, tools or equipment owned or rented by the Contractor which are utilized in the performance of the Work but not incorporated into the permanent improvements. The Contractor shall, at the Contractor's own expense, provide insurance coverage for owned or rented machinery, tools, or equipment which shall be subject to the provisions of Section 11.3.7.

**11.3.1.7** Owner shall not be responsible to or for the Contractor or Subcontractors against any loss by fire, lightning, extended coverage, all risk, theft or vandalism and malicious mischief, of any tools, equipment, vehicles, shanties, tool houses, trailers, or other temporary or permanent structures wherever located and owned by the Contractor, Subcontractors, their employees or agents.

**11.3.2** Boiler and Machinery Insurance. The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Construction Manager, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

**11.3.3** Loss of Use Insurance. The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused.

**11.3.4** If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

**11.3.5** If during the Project construction period the Owner insures properties, real or personal or both, adjoining or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

**11.3.6** Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project.

**11.3.7** Waivers of Subrogation. The Owner and Contractor waive all rights against each other and any of their Consultants, Architects, Construction Manager, subcontractors, sub-subcontractors,

agents and employees each of the other and Owner's separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Article 11 or other insurance applicable to the Work, except such rights as the Owner and Contractor may have to the proceeds of such insurance held by the Owner as fiduciary. The Contractor shall require each of the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged. To the extent that a waiver of subrogation is unavailable to the Owner and the absence of such right of subrogation, or the Owner's giving such a waiver, would constitute a breach of its insurance policy; then as to the Owner this Section.

11.3.7 shall be of no force or effect and no such waiver of subrogation shall be required of Owner.

11.3.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

11.3.9 The Owner, as fiduciary, shall have the power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five (5) days after occurrence of loss to the Owner's exercise of this power.

11.3.10 All insurance policies maintained by the Contractor shall include a waiver of any and all rights of subrogation of the Contractor or its Insurers against the Owner and Architect, along with all other Additional Insureds/Indemnified Parties and their agents, officers, directors and employees for recovery of damages. Contractor further waives its right of subrogation against the Owner or any Additional Insured or Indemnified Party for any damage or loss to the Contractor's scope of work, tools, equipment, materials or any other loss within the scope of any insurance maintained by the Owner.

#### **11.4 Performance Bond and Payment Bond**

11.4.1 As required in the Invitation and Instructions to Bidders, the Contractor shall furnish a Performance Bond and Payment Bond, each in an amount equal to one hundred percent (100%) of the Contract Sum, meeting all statutory requirements of the State of New York, in form and substance satisfactory to the Owner and, without limitation, complying with the following specific

**requirements:**

- 1. Except as otherwise required by statute, the form and substance of such bonds shall be satisfactory to the Owner in the Owner's sole judgment;**
- 2. The cost of the required bonds shall be included in the Contract Sum;**
- 3. Bonds shall be executed by a responsible surety licensed in the Jurisdiction of the Work with a Best's rating of no less than A/XII and shall remain in effect for a period not less than two (2) years following the date of Substantial Completion or the time required to resolve any items of incomplete Work and the payment of any disputed amounts, whichever time period is longer;**
- 4. The Performance Bond and the Labor and Material Payment Bond shall each be in an amount equal to the Contract Sum;**
- 5. The Contractor shall require the attorney in fact who executes the required bond on behalf of the surety to affix thereof a certified and current copy of his power of attorney indicating the monetary limit of such power;**
- 6. Every Bond under this Section 11.4.1 must display the Surety Bond Number. A rider including the following provisions shall be attached to each Bond:**
  - 1. Surety hereby agrees that it consents to and waives notice of any addition, alteration, omission, change, or other modification of the Contract Documents. Such addition, alteration, change, extension of time, or other modification of the Contract Documents, or a forbearance on the part of either the Owner or the Contractor to the other, shall not release the Surety of its obligations hereunder and notice to the Surety of such matters is hereby waived.**
  - 2. Surety further agrees that in event of any default by the Owner in the performance of the Owner's obligations to the Contractor under the Contract, the Contractor or Surety shall cause written notice of such default (specifying said default in detail) to be given to the Owner, and the Owner shall have thirty (30) days from time after receipt of such notice within which to cure such default, or such additional reasonable period of time as may be required if the nature of such default is such that it cannot be cured within thirty (30) days. Such Notice of Default shall be sent by certified registered U.S. Mail, return receipt requested, first class postage prepaid, to the Architect and the Owner.**
- 7. Notwithstanding anything to the contrary set forth in the Contract Documents, the Performance Bond shall not contain a condition that any meeting must be scheduled among Owner, Contractor and its surety, or any combination of them, prior to Owner declaring Contractor in default or prior to Owner terminating Contractor's Contract. Any such language in a Performance Bond shall be null, void and unenforceable.**

**11.4.2** Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

**11.4.3** The Contractor shall deliver the required bonds to the Owner prior to beginning construction activity at the site, but no later than seven (7) days after execution of the Contract. Said bond shall be issued on form AIA Document A312.

**11.4.4** The Owner may, in the Owner's sole discretion and without prior notice to the Contractor, inform surety of the progress of the Contractor's Work and obtain consents as necessary to protect the Owner's rights, interest, privileges of the Contractor's Work and obtain consents as necessary to protect the Owner's rights, interest, privileges and benefits under and pursuant to any bond issued in connection with the Contractor's Work.

**11.4.5** If the surety on any Bond furnished by the Contractor is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of this Article, the Contractor shall within ten (10) days thereafter substitute another Performance and Payment Bond and surety, both of which must be acceptable to the Owner.

**11.4.6** The Contractor shall keep the surety informed of the progress of the Work, and, where necessary, obtain the surety's consent to, or waiver of: (1) notice of changes in the Work; (2) request for reduction or release of retention; (3) request for final payment; and (4) any other material required by the surety. The Owner, Construction Manager and Architect shall be notified by the Contractor, in writing, of all communications with the surety. The Owner may, in the Owner's sole discretion, inform surety, through the Construction Manager, of the progress of the Work and obtain consents as necessary to protect the Owner's rights, interest, privileges and benefits under and pursuant to any bond issued in connection with the Work.

**11.5** Effect of Procurement of Insurance- Neither the procurement nor the maintenance of any type of insurance by the Owner or the Contractor shall in any way be construed or be deemed to limit, discharge, waive or release the Contractor from any of the obligations and risks imposed upon him by the Contract or to be a limitation on the nature or extent of such obligations or risks.

**11.6** No Third Party - Nothing in the Contract shall create or give to third parties any claim or right of action against the Contractor, Architect, Construction Manager or Owner beyond such as may legally exist irrespective of the Contract.

## **ARTICLE 12 INDEMNIFICATION**

A. The Contractor and its subcontractors shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, and any of their respective employees, or agents from and against any and all claims, damages, losses, suits, obligations, fines, penalties, costs, charges and expenses, including but not



limited to attorneys' fees, which may be imposed upon or incurred by or asserted against any of them by reason of any act or omission of such Contractor or any of its subcontractors or any person or firm directly or indirectly employed by such Contractor, for the act(s) and/or omission(s) of any Contractor or Subcontractor in connection with the work of the Project.

B. To the fullest extent permitted by law, the Contractor and its subcontractors shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, and any of their respective employees, or agents from and against claims, damages, losses and expenses including but not limited to attorneys' fees, arising out of or resulting from performance of its work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction, of tangible property including loss of use resulting therefrom, but only to the extent caused in whole or in part by negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Paragraph B. The Contractor's indemnity obligations under this Paragraph B shall, but not by way of limitation, specifically include all claims and judgments which may be made against the Owner, the Architect, the Architect's consultants and agents and employees of any of them under any applicable statute, rule or regulation including the New York Statute, Occupational Safety and Hazardous Act, and the Federal Occupational Safety and Hazardous Act. In claims against any person or entity indemnified under this Paragraph B by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Paragraph B shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

C. The Contractor and its subcontractors shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, and any of their respective employees or agents against any fines, penalties, judgments, or damages, including reasonable attorney's fees, imposed on or incurred by the parties indemnified hereunder which are incurred as a result of the Contractor's failure to give the notices required by Article 6(T) of these General Conditions of the Contract for Construction.

D. The Contractor and its subcontractors shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, and any of their respective employees or agents against any actions, lawsuits or proceedings or claims of liens brought against each or any of them as a result of liens filed against the Contractor's project funds, including all the cost and expense of said liens, and including but not limited to attorneys' fees incurred by each or any of them.

E. The Contractor and its subcontractors shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, and any of their respective employees or agents of and from any and all liability for violation of any laws and regulations applicable to the Contractor's work and shall defend any claims or actions which may be brought against the Owner as the result thereof. In the event that the Contractor shall fail to refuse to defend any such action, the Contractor shall be liable to the Owner for all costs of the Owner in defending such claim or action and all costs of the Owner, including attorney's fees, in recovering such defense costs from the Contractor.

F. The Contractor and its subcontractors shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, and any of their respective employees or agents of and from any and all liability for claims made by third parties, including subcontractors, in connection with this Agreement and shall defend any claims or actions which may be brought against the Owner as the result thereof. In the event that the Contractor shall fail to refuse to defend any such action, the Contractor shall be liable to the Owner for all costs of the Owner in defending such claim or action and all costs of the Owner, including attorney's fees, in recovering such defense costs from the Contractor.

G. The indemnification obligations set forth herein shall become effective upon the Owner, Architect or Construction Manager's receipt of a claim for which the Contractor is required to provide indemnification to the Owner, Architect or Construction Manager. In the event the Owner, Architect or Construction Manager is required to bring an action to enforce the indemnification obligation, the Contractor shall be liable to the Owner, Architect, and/or Construction Manager for all costs associated with said action including attorneys' fees.

### **ARTICLE 13**

#### **TIME FOR COMPLETION OF WORK**

A. The date of commencement of the Contractor's work shall be as indicated in the agreement between the Contractor and the Owner. The date shall not be postponed or extended by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible to act. Time limits stated in the agreement between the Owner and the Contractor are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

B. The Contractor shall not commence work on the site until two certified copies of all insurance policies and bonds required by Article 10 and Article 11 of these General Conditions of the Contract for Construction are provided to the Owner and accepted by the Owner. The date of commencement and/or completion of the Contractor's work shall not be changed by the effective date of such insurance. The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the acceptance of the insurance and bonds required by Article 10 and Article 11 of these General Conditions.

C. The Contractor shall proceed expeditiously with adequate forces and shall achieve substantial completion of its contract in accordance with the schedule set forth in its agreement. The Contractor shall cooperate with the Owner, Architect, Construction Manager, and other Contractors on the Project, making every reasonable effort to reduce the contract time.

D. 1. In the event the Owner determines that the performance of the Contractor's work, as of a milestone date, has not progressed or reached the level of completion required by its contract, the Owner shall have the right to order the Contractor to take corrective measures necessary to expedite the progress of construction, including, without limitation, (1) working additional shifts or overtime, (2) supplying additional manpower, equipment, and facilities and (3) other similar measures (hereinafter referred to collectively as "Extraordinary Measures"). Such Extraordinary Measures shall continue until the Contractor progresses its work in compliance with the stage of completion required by its agreement with the Owner. The Owner's right to require Extraordinary Measures is solely for the purpose of ensuring the Contractor's compliance with the construction schedule.

2. The Contractor shall not be entitled to an adjustment in its contract sum in connection with Extraordinary Measures ordered by the Owner under or pursuant to this Paragraph D.

3. The Owner may exercise the rights furnished the Owner under or pursuant to this Paragraph D as frequently as the Owner deems necessary to ensure that the Contractor's performance of its work will comply with any Milestone Date or completion date set forth in the Contractor's agreement with it.

4. The Owner reserves the right to withhold payment from the Contractor until such time as the Contractor submits a daily schedule showing work to be again on schedule with the Construction Schedule and/or until its work is being installed according to the project construction schedule, without additional cost to the Owner.

E. The Contractor shall achieve substantial completion of its work in accordance with the schedule for the work set forth in the project manual included as part of its agreement with the Owner. Milestone Dates are dates critical to the Owner's operations that establish when a part of the work is to commence or be complete. All Milestone Dates are of the essence and shall have the same meaning as Substantial Completion for the purpose of Liquidated Damages in this Article 13.

F. Substantial completion shall be achieved by the Contractor when the Contractor has completed ninety eight (98%) of its work. Work remaining to be completed after substantial completion shall be limited to items which can ordinarily be completed within the period between the payment at the time of substantial completion and final payment.

G. 1. This project is to be physically completed in accordance with the time limits set forth in the agreement between the Owner and Contractor and as further set forth in the project manual and/or bidding documents. Liquidated damages will be assessed in the amount of \$1,000.00 for each and every calendar day after such time allowed for completion.

2. Contractor realizes that time is of the essence on this Contract and the completion date and milestone date for each work item in its agreement, a Milestone Date reflected on the project schedule, or the date of substantial completion of the Contractor's work shall be no later than the date indicated therein. In the event the Contractor fails to complete any work or substantially complete the work under this contract by said schedule date, the sum per calendar day for each date not met, as delineated above, will be subtracted from the payment due the Contractor (or, if the amount due Contractor as payment is insufficient, any deficiency shall be paid by the Contractor to the Owner), except in cases where the Contractor has applied for and been granted an extension of time in accordance with the provisions of this Article 13.

3. The said sum per calendar day shall constitute the Liquidated Damages incurred by the Owner for each day of delay beyond the agreed upon dates of Substantial Completion. Such Liquidated Damages shall be in addition to any other damages (other than by reason of delay) Owner may incur as a result of Contractor's breach of Contract. In the event that substantial completion of its work is not achieved in accordance with the project schedule, inspections will be performed once each week unless the Owner or the Architect determines, at their sole discretion, that additional inspections are not needed. All costs incurred by the Owner, Owner's Representative and the cost of additional inspections, at the rate of One Thousand Dollars (\$1,000) per inspection, will be subtracted from payment due the Contractor. If the amount due the Contractor for payment is insufficient, any deficiency shall be paid by the Contractor to the Owner.

H. 1. Within five (5) calendar days from the occurrence of same, the Contractor must apply in writing to the Owner, its Architect or Construction Manager for an extension of time to complete its work where it has been delayed as a result of: unforeseeable causes beyond the control and without the fault or negligence of the contractor, including acts of God, acts of the public enemy, acts of the federal or state government in either their sovereign or contractual capacities, fires, floods, epidemics, quarantine restrictions, priority or allocation orders duly issued by the federal government; freight embargoes; changes in the work to be performed by the Contractor. The Contractor may not apply for an extension of time for delays in acquisitions of materials other than by reason of freight embargoes. All other delays of the project, including but not limited to, Architect review and/or approval of shop drawings and/or submittals, requests for information, clarifications, samples, and change orders; Owner schedule; Architect certification of payment; payment by Owner of Contractor's Application for Payment; coordination amongst Contractors; unavailability of materials and/or equipment; surveying/testing; closeout, etc. are deemed to be foreseeable and, therefore shall not form the basis for a claim for an extension of time by the Contractor.

2. All claims for additional time shall be supported by documentation which demonstrates to the Architect and Construction Manager's satisfaction that the Critical path of the Work has been significantly altered by the delays to the activities in question, and that the schedule cannot be maintained by re-ordering other activities within the project at no cost. Upon receipt of the Contractor's request for an extension of time, the Owner will ascertain the facts and extent of the delay, and may, in its sole discretion, extend the time for completion of the Contractor's work when in its judgment such an extension is justified. The Owner's

determination will be final and binding in any litigation commenced by the Contractor against the Owner which arises out of the Owner's denial of an extension of time to the Contractor. Any approval of an extension of the Contractor's time to complete its work shall be memorialized by written change order, signed by the Owner, Contractor, Architect and Construction Manager. Where the Owner determines that the Contractor will be granted an extension of time, such extension shall be computed in accordance with the following:

For each day of delay in the completion of its work, the Contractor shall be allowed one day of additional time to complete its contract. The Contractor shall not be entitled to receive a separate extension of time for each one of several causes of delay operating concurrently; only the actual period of delay as determined by the Owner or its Architect may be allowed.

3. Notwithstanding anything to the contrary in the Contract Documents, an extension in the contract time, to the extent permitted under subparagraph H of this Article 13, shall be the sole remedy of the Contractor for any (1) delay in the commencement, prosecution, or completion of the Work; (2) hindrance or obstruction in the performance of the Work; (3) loss of productivity or acceleration; or (4) other similar claims (collective referred to herein as "delay(s)"), unless a delay is caused by the Owner's active interference with the Contractor's performance of the Work, and only to the extent such acts continue after the Contractor furnishes the Owner with three (3) days' written notice of such interference. In no event shall the Contractor be entitled to any compensation or recovery of any damages in connection with any Delay, including, but not limited to, consequential damages, lost opportunity costs, impact damages, or other similar remuneration. The Owner's exercise of any of its rights or remedies under the Contract Documents (including, but not limited to, ordering changes in the Work, or directing suspension, rescheduling or correction of the Work), regardless of the extent or frequency of the Owner's exercise of such rights or remedies, shall not be construed as active interference with the Contractor's performance of the Work.

#### **ARTICLE 14**

#### **DEFICIENT AND INCOMPLETE WORK**

A. The Owner, through its Architect or Construction Manager, will have the authority to reject work performed by the Contractor which does not conform to the requirements of the drawings and/or specifications.

B. The Owner, through its Architect or Construction Manager, shall have the authority to require additional inspection or testing of the Contractor's work whether or not such work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons performing portions of the work to have performed additional inspection or testing of the work.

C. 1. If a portion of the Contractor's work is covered contrary to the Architect's request

or to requirements specifically expressed in the drawings and/or specifications, upon request by the Architect or the Construction Manager, the Contractor shall uncover such work for the Architect's or any governmental authority's observation and be replaced at the Contractor's sole expense without change in the Contract Time or Contract Sum.

2. If a portion of the Contractor's work has been covered which the Architect or any governmental authority has not specifically requested to observe prior to its being covered, the Architect or any governmental authority may request to see such work and it shall be uncovered by the Contractor. If such work is in accordance with the drawings and/or specifications, costs of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such Work is not in accordance with the Contract Documents, the Contractor, at its sole cost and expense, shall uncover and replace such work.

D. The Contractor shall promptly correct work rejected by the Owner, through its Architect or Construction Manager, or failing to conform to the requirements of its contract with the Owner, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear the all costs of correcting such rejected work, including but not limited to the cost of said additional testing and/or inspection, the cost of the Architect's services incurred in conjunction with such additional testing, and any cost, loss or damages to the Owner resulting from such actions. If prior to the date of Substantial Completion, the Contractor, a Sub-contractor or anyone for whom either is responsible uses or damages any portion of the Work or premises, including, without limitation, mechanical, electrical, plumbing and other building systems, machinery, equipment or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner.

E. If the Contractor (1) fails to correct work which is not in accordance with the requirements of its agreement with the Owner, or (2) fails to carry out its work in accordance with the requirements of its agreement with the Owner, or (3) fails or refuses to provide a sufficient amount of properly supervised and coordinated labor, materials, or equipment so as to be able to complete the work within the contract time, or (4) fails to remove and discharge (within ten (10) days) any lien filed upon Owner's property by anyone claiming by, through, or under the Contractor, or (5) disregards the instructions of the Architect, Owner or Construction Manager, the Construction Manager, on behalf of the Owner may order the Contractor to stop its work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity. This right shall be in addition to, and not in restriction of, other rights the Owner may have pursuant to these General Conditions or at law.

F. 1. If the Contractor defaults or neglects to carry out its work in accordance with its agreement with the Owner and fails within a three (3) day period after receipt of written notice from the Construction Manager to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Architect, the Construction Manager and the Owner

and such other consultants whose participation is deemed necessary by the Architect, for additional services and expenses made necessary by such default, neglect or failure. Such action by the Construction Manager, including the amounts to be charged to the Contractor as a result of such action are subject to the prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

2. Where the Contractor's default and/or neglect to carry out its work in accordance with its agreement with the Owner threatens the health, safety and/or welfare of the occupants of the school district's facilities and/or threatens the structural integrity and/or preservation of the school district's facilities, the Owner may proceed to carry out the Contractor's work upon twenty-four (24) hours' notice of its intention to do so to the Contractor.

G. If the Owner prefers to accept work which is not in accordance with the terms and conditions of the agreement between the Owner and the Contractor, the Owner may, in its discretion, accept such work and reduce the Contractor's contract sum accordingly.

## **ARTICLE 15**

### **FINAL COMPLETION AND CLOSEOUT OF THE PROJECT**

A. 1. When advised by the Construction Manager that the Contractor's work is near substantial completion, the Architect shall visit the site to determine whether the Contractor's work is substantially complete. If the Architect's observations of the Contractor's work discloses any item which has not been performed in accordance with the requirements of the drawings and/or specifications and/or which has not been completed to the point indicated in Article 13 paragraph F of these General Conditions, the Contractor shall complete or correct such items upon receipt of notification from the Architect that a deficiency exists. The Architect shall not issue a certificate of substantial completion for the work of the Contractor until the work has been completed in accordance with Article 13(F). Upon completion of the work outlined by the Architect to it in accordance with this paragraph A, the Contractor shall advise the Architect of the need for an inspection of the work. If the Architect is required to inspect the Contractor's work more than twice, the Contractor shall be liable to the Owner for the services performed by the Architect as a result of additional inspections.

2. Upon determining that the Contractor's work has progressed to the point of Substantial Completion, the Architect shall prepare a punch list of the Contractor's work which shall include only minor items of work remaining to be performed by the Contractor to bring its work into compliance with the requirements of the drawings and/or specifications. The Contractor shall proceed promptly to complete and correct items on the punch list issued by the Architect and shall complete said items within thirty (30) days of its receipt of the punch list from the Architect. At the time of substantial completion, the Owner shall retain 200 percent of the value of the punch list items from the Contractor's remaining contract sum. The value of said remaining work shall be determined by the Architect. Upon completion of the work reflected in the final punch list, the Owner shall release the monies withheld pursuant to this paragraph to the Contractor.

3. The Architect's failure to include an item of deficiency on the punch list issued to the Contractor shall not relieve the contractor of its responsibility to perform its work in accordance with the drawings and/or specifications.

B. 1. If within three (3) years after the date of Substantial Completion of the Contractor's work or designated portion thereof, or after the date for commencement of warranties established pursuant to these General Conditions, or by terms of in applicable special warranty required by the agreement between the Owner and the Contractor, any of the Work is found to be not in accordance with the requirements of said agreement, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. This period of three (3) years shall be extended with respect to portions of the Contractor's work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of such work. The obligation set forth hereunder shall survive acceptance by the Owner of the Contractor's and/or termination of the Contractor's agreement with the Owner. The Owner shall give such notice within a reasonable period of time after discovery of the condition.

2. The Contractor shall, within a reasonable time after receipt of written notice thereof, but in no event no later than seventy-two (72) hours after receipt of such notice, commence to correct, repair, and make good any defects in its work.

3. The obligations of the Contractor pursuant to this paragraph shall cover any repairs to or replacement of work affected by the defective work.

4. In the case of any work performed in correcting defects pursuant to this paragraph, the guarantee periods specified herein shall begin anew from the date of acceptance by the Owner of such work.

C. Upon receipt of written notice from the Construction Manager that the Contractor's work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Contractor's work acceptable pursuant to the terms and conditions of its agreement with the Owner and the Contract fully performed and upon receipt of the closeout documentation required by the Contract Documents and elsewhere in the agreement between the Owner and the Contractor, the Architect will certify to the Owner that the Contractor is entitled to final payment on the project.

D. 1. Prior to receipt of final payment from the Owner, the Contractor shall provide to the Architect the close out documentation required by the Contract Documents.

2. The Contractor shall schedule a close out meeting with the Architect and the Construction Manager for the purpose of delivering the close out documents required pursuant to the Contract Documents and elsewhere in the agreement between the Owner and the Contractor.

E. If the Contractor's work is not accepted by the Owner after final inspection and additional time is required to complete items identified during the final inspection, the date starting the



warranty periods described in the Contract Documents shall be set by the Architect at his discretion.

F. If the Architect is required to perform more than one final inspection because the Contractor's work fails to comply with the requirements of the contract, the amount of compensation paid to the Architect by the Owner for additional services shall be deducted from the final payment to the Contractor.

G. Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those claims previously made in writing in accordance with the terms of Article 18 hereof and identified by that payee as unsettled at the time of final Application for Payment.

H. Contractor shall submit all documentation identified in this section within ninety (90) days from the date of Substantial Completion. If the documentation has not been submitted, the Owner will obtain same through whatever means necessary. The Contractor shall solely be responsible for all expenses incurred by the Owner in securing such documentation.

## **ARTICLE 16 RELEVANT STATUTORY PROVISIONS**

A. The Contractor shall at all times observe and comply with all Federal and State Laws and all Laws, Ordinances and Regulations of the Owner, in any manner affecting the work and all such orders decreed as exist at present and those which may be enacted later, by bodies or tribunals having jurisdiction or authority over the work, and the Contractor shall indemnify and save harmless the Owner and all his officers, agents, or servants against any claim or liability arising from, or based on, a violation of any such law, ordinances, regulation, order or decree, whether by himself or by his employee or agents.

B. The Contractor and each of its subcontractors shall comply with Prevailing Wage Rates as issued by the State of New York Department of Labor for the location and duration of this Project and shall comply with all requirements governing its payments to its employees as set forth in Labor Law, section 220 et seq of the New York State Labor Law, as amended.

C. The Contractor and each of its subcontractors shall post a notice at the beginning of the performance of every public work contract on each job site that includes the telephone number and addresses for the Department of Labor and a statement informing laborers, workers or mechanics of their right to contact the Department of Labor if he/she is not receiving the proper prevailing rate of wages and/or supplements for his/her particular job classification.

D. The Contractor specifically agrees, as required by Labor Law, Sections 220 and 220-d, as amended, that:

1. No laborer, workman or mechanic in the employ of the Contractor, subcontractor or other person doing or contracting to do the whole or any part of the work contemplated by the Contract, shall be permitted or required to work more than eight

hours in any one calendar day or more than five days in any one week, except in the emergencies set forth in the Labor Law.

2. The wages paid for a legal day's work shall not be less than the prevailing rate of wages as defined by law.

3. The minimum hourly rate of wages to be paid shall not be less than that stated in the Project Manual, and any re-determination of the prevailing rate of wages after the Contract is approved shall be deemed to be incorporated herein by reference as of the effective date of re-determination and shall form a part of this Contract. The Labor Law provides that the Contract may be forfeited, and no sum paid for any work done thereunder on a second conviction for willfully paying less than:

a. The stipulated wage scale as provided in Labor Law, Section 220, Sub division 3, as amended; or

b. The stipulated minimum hourly wage scale as provided in Labor Law, Section 220-d, as amended.

E. The Contractor acknowledges that its work is governed by the provisions of Section 101 of the General Municipal Law of the State of New York.

F. The Contractor specifically agrees, as required by the provisions of the Labor Law of New York, Section 220-E, as amended that:

1. In the hiring of employees for the performance of this contract or any sub-contractor hereunder, no contractor, sub-contractor, nor any person acting on behalf of such contractor or sub-contractor shall by reason of race, creed, color or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates.
2. No contractor, sub-contractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under this contract on account of race, color, creed, sex or national origin.
3. There may be deducted from the amount payable to the Contractor a penalty of fifty dollars for each person for each calendar day during which such person was discriminated against or intimidated in violation of the provisions of the Contract.
4. This Contract may be canceled or terminated by the Owner and all monies due or to become due hereunder may be forfeited for a second or any subsequent violation of the terms or conditions of this section of the Contract.

The aforesaid provisions of this section covering every Contract for or on behalf of the Owner, the State or a municipality for the manufacture, sale or distribution of materials, equipment or supplies shall be limited to operations performed within the territorial

limits of the State of New York.

G. The successful Contractor shall conform to the guidelines spelled out in the County's Affirmative Action Program, if any.

H. The Contractor shall comply with all of the provisions of the Immigration Reform and Control Act of 1986 and regulations promulgated pursuant thereto and shall require its subcontractors to comply with same. The Contractor shall and does hereby agree to fully indemnify, protect, defend, and hold harmless the Owner, Owner's agents and employees from and against any penalties, fees, costs, liabilities, suits, claims, or expenses of any kind or nature, including reasonable attorney's fees, arising out of or resulting from any violation or alleged violation of the provisions of said laws in connection with the work performed hereunder.

I. This Contract shall be void if the Contractor fails to install, maintain, and effectively operate appliances and methods for the elimination of harmful dust when a harmful dust shall have been identified in accordance with Section 222-a of the Labor Law of the State of New York.

J. The Contractor shall insure that absolutely no asbestos containing material is used in conjunction with the performance of its work. The Contractor bears the sole responsibility to provide assurances that no asbestos containing material is built into the construction, or that any equipment used in the construction contains any asbestos containing material. If asbestos containing material is found, at any time during or after the construction is completed, it shall be the responsibility of the Contractor who installed said material to remove it and replace it with new non-asbestos containing material, as per federal, state and local mandates.

K. Large and small asbestos abatement projects as defined by 12 N.Y.C.R.R. 56 shall not be performed while the building is occupied. As referenced in this section, the term "Abuilding" shall mean a wing or major section of a building that can be completely isolated from the rest of the building with sealed non-combustible construction. The isolated portion of the building must contain exits that do not pass through the occupied portion, and ventilation systems must be physically separated and sealed at the isolation barrier. Exterior work such as roofing, flashing, siding or soffit work may be performed on occupied buildings provided proper variances are in place as required, and complete isolation of ventilation systems and windows is provided. Work must be scheduled so that classes are not disrupted by noise or visual distraction.

L. Surfaces that will be disturbed by reconstruction must have a determination made as to the presence of lead. Projects which disturb surfaces that contain lead shall have in the specifications a plan prepared by a certified Lead Risk Assessor or Supervisor which details provisions for occupant protection, worksite preparation, work methods, cleaning and clearance testing which are in general accordance with the HUD Guidelines.

M. No smoking is allowed anywhere on school property per New York State and County law. Violators are subject to a \$1,000 fine and/or banishment from the property.

N. Applicable codes and standards for material furnished and work installed shall include all state laws, local ordinances, requirements of governmental agencies having jurisdiction, and

applicable requirements of following codes and standards, including but not limited to:

1. New York State Uniform Fire Prevention and Building Code, and amendments thereto.
2. New York State Energy Conservation Construction Code.
3. State Education Department Manual of Planning Standards.
4. New York State Department of Transportation, Office of Engineering, Standard Specification, Construction and Materials, latest edition.
5. Life Safety Code - NFPA.

O. Wherever in the specifications reference is made to ANSI or ASTM Standards, Federal Specifications, Consumer Product Standards, or similar recognized standards, the latest edition of the respective publishing agency in effect at the date of "Bid Issuance" shall be accepted as establishing the technical requirements for which compliance is required.

P. The Owner shall be entitled to request of Contractor or its successor in interest adequate assurance of future performance in accordance with the terms and conditions of its agreement in the event (1) an order for relief is entered on behalf of the Contractor pursuant to Title 11 of the United States Code, (2) any other similar order is entered under any other debtor relief laws, (3) the Contractor makes a general assignment for the benefit of its creditors, (4) a receiver is appointed for the benefit of its creditors, or (5) a receiver is appointed on account of its insolvency. Failure to comply with such request within ten (10) days of delivery of the request shall entitle the Owner to terminate the Contract in accordance with Article 17 hereof. In all events, pending receipt of adequate assurance of performance and actual performance in accordance therewith, the Owner shall be entitled to proceed with the Contractor's work with its own forces or with other contractors on a time and material or other appropriate basis, the cost of which will be back charged against the Contractor.

Q. The Contractor shall maintain policies of employment as follows:

1. The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.
2. The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

**ARTICLE 17**  
**TERMINATION OR SUSPENSION**

- A. 1. The Owner may terminate the Contractor's agreement in the event the Contractor:
- a. refuses or fails to supply sufficient skilled workers or suitable materials or equipment to complete the Work in a diligent, efficient, timely, workmanlike, skillful, and careful manner;
  - b. refuses or fails to correct deficient work performed by it;
  - c. fails to make prompt payments to subcontractors for labor, materials, and/or equipment in accordance with the respective agreements between the Contractor and the Subcontractors;
  - d. disregards laws, ordinances, rules, regulations, or orders of a public authority having jurisdiction;
  - e. disregards the instructions of the Architect, Construction Manager or the Owner (when such instructions are based on the requirements of the Contract Documents);
  - f. is adjudged a bankrupt or insolvent, or makes a general assignment for the benefit of Contractor's creditors, or a trustee or receiver is appointed for Contractor or for any of its property, or files a petition to take advantage of any debtor's act or to reorganize under bankruptcy or similar laws; or
  - g. breaches any warranty made by the Contractor under or pursuant to the Contract Documents.
  - h. fails to furnish the Owner with assurances satisfactory to the Owner evidencing the Contractor's ability to complete the Work in compliance with all the requirements of the Contract Documents; or
  - i. fails after commencement of the Work to proceed continuously with the construction and completion of the Work for more than ten (10) days, except as permitted under the Contract Documents.
  - j. fails to keep the Project free from strikes, work stoppages, slowdowns, lockouts or other disruptive activity;
  - k. or otherwise does not fully comply with the Contract Documents.

2. When any of the above reasons exists, may without prejudice to any other rights or remedies of the Owner, terminate employment of the Contractor upon three (3) days written notice and may, subject to any prior rights of the surety:

- a. take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- b. take possession of materials stored off site by the Contractor;
- c. take assignments of the Contractor's subcontractors in accordance with these General Conditions;
- d. finish the Work by whatever reasonable method the Owner may deem expedient.

3. When the Owner terminates the Contract for one of the reasons stated in Subparagraph 1 hereof, the Contractor shall not be entitled to receive further payment until the completion of the Contractor's work. If the Owner's costs to complete the Contractor's work, including the expenses incurred by the Owner in connection with the services of the Architect, the Construction Manager and/or other consultants, exceed the contract balance remaining on the Contractor's contract, the Contractor shall be liable to the Owner for such excess costs. This provision shall survive termination of the Contractor's agreement with the Owner.

B. 1. In addition to the Owner's right to carry out the work of the Contractor pursuant to its agreement with the Contractor, the Owner may at any time, at will and without cause, terminate any part of the Contractor's work or all of the Contractor's remaining work for any reason whatsoever by giving three (3) days' written notice to Contractor, specifying the portion of the Contractor's work to be terminated and the effective date of termination.

2. Upon receipt of a notice of termination for convenience, the Contractor shall immediately, in accordance with instructions from the Owner, proceed with performance of the following duties regardless of delay in determining or adjusting amounts due under this Paragraph:

- a. cease operation as specified in the notice;
- b. place no further orders and enter into no further subcontracts for materials, labor, services or facilities except as necessary to complete continued portions of the Contract;
- c. terminate all subcontracts and orders to the extent they relate to the Work terminated;
- d. proceed to complete the performance of the remaining work on its contract which has not been so terminated; and
- e. take actions that may be necessary, or that the Owner may direct, for the protection and preservation of the terminated Work.

3. The Contractor shall continue to prosecute that portion of its work which has not been terminated by the Owner pursuant to this paragraph. If the Contractor's work is so terminated, the Owner shall not be liable to the Contractor by reason of such termination except that the Contractor shall be entitled to payment for the work it has properly executed in accordance with its agreement and prior to the effective date of termination (the basis for such payment shall be as provided in the Contract) and for costs directly related to work thereafter performed by Contractor in terminating such Work, provided such work is authorized in advance by the Architect and the Owner. No payment shall be made by Owner, however, to the extent that such work is, was, or could have been terminated under the Contractor's agreement with the Owner.

4. In case of a termination pursuant to this paragraph B, the Owner will issue a Construction Change Directive or authorize a Change Order, making any required adjustment to the Date of Substantial Completion and/or the sum of contract monies remaining to be paid to the Contractor. The Owner shall be credited for (1) payments previously made to the Contractor for the terminated portion of the Work, (2) claims which the Owner has against the Contractor under the Contract and (3) the value of the materials, supplies, equipment or other items that are to be disposed of by the Contractor that are part of the Contract Sum; multiplied by 15% representing the Contractor's overhead and profit.

5. For the remaining portions of the Contractor's work which have not been terminated pursuant to this paragraph B, the terms and conditions of the Contractor's agreement with the Owner shall remain in full force and effect.

6. Upon termination of the Contractor's work or a portion of the Contractor's work pursuant to this paragraph B, the Contractor shall recover as its sole remedy, payment for work which it has properly performed in connection with the terminated portion of the Work prior to the effective date of termination and for items properly and timely fabricated off the Project site, delivered and stored in accordance with the Owner's instructions. The Contractor hereby waives and forfeits all other claims for payment and damages, including, without limitation, overhead and profit related to work terminated by the Owner pursuant to this paragraph B.

C. 1. In addition to Owner's right to suspend, delay, or interrupt Contractor from proceeding with any portion of its work pursuant to the terms and conditions of its agreement with the Owner, the Owner may at any time, at will and without cause suspend, delay, or interrupt any part of the Contractor's work or all work for any reason whatsoever for such period of time as the Owner may determine by giving three (3) days' prior written notice to Contractor, specifying that portion of the Contractor's work which is to be suspended, delayed, or interrupted, and the effective date of such suspension, delay, or interruption, as the case may be.

2. The Contractor shall continue to prosecute that portion of its work which has not been suspended, delayed, or interrupted, and shall properly protect and secure the portion of its work so suspended, delayed or interrupted.

3. The Owner shall incur no liability to Contractor by reason of such suspension, delay, or interruption except that Contractor may request an extension of its time to complete its

work in accordance with Article 13 hereof.

D. The Contractor agrees and acknowledges that payments for the work have been obtained through obligations or bonds which have been sold after public referendum. In the event the work is suspended or canceled as a result of the order of any court, agency, department entity or individual having jurisdiction, or in the event the work is suspended or canceled due to the fact that a court, agency, department, entity or individual having jurisdiction has issued an order, the result of which is that the aforesaid obligations or bonds are no longer available for payment for the work, the Contractor expressly agrees that it shall be solely entitled to payment for work accomplished until a notice of suspension or cancellation is served upon it. The Contractor expressly waives any and all rights to institute an action, claim, cause of action or similar for any damages it may suffer as a result of the suspension or cancellation of the Work and/or its contract pursuant to this section.

## **ARTICLE 18 CLAIMS AND DISPUTES**

A. Definition. A "Claim" is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract.

B. Time Limits on Claims. Claims by the Contractor must be made within thirty (30) days after occurrence of the event giving rise to such Claim, or within thirty (30) days after the claimant first recognizes the condition giving rise to the Claim, whichever is earlier. Claims must be made by written notice. An additional Claim made after the initial Claim has been decided by the Owner will not be considered unless submitted in a timely manner. Failure of the Contractor to give timely notice of claim shall constitute waiver of the claim. Claims must be made by written notice to the Construction Manager, Architect and Owner. The responsibility to substantiate Claims shall rest with the Contractor.

C. Pending final resolution of a Claim, unless otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

D. Claims for Concealed or Unknown Conditions. If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the Contractor shall be given to the Owner and Architect promptly before conditions are disturbed and in no event later than five (5) days after first observance of the conditions; and, (3) in the case of a condition at the site which involves a hazardous or toxic substance, as those terms are defined by OSHA or AHERA, notice to the Owner, the Construction Manager and the Architect shall be given immediately upon discovery of such hazardous or toxic substance. The



Architect, and/or Construction Manager will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall so notify the Contractor in writing, stating the reasons.

E. Claims for Additional Cost. If the Contractor wishes to make Claim for an increase in the Contract Sum as a result of a Change in the Work pursuant to Article 8 of these General Conditions, written notice as provided in this Article 18 shall be given before proceeding to execute the Work.

F. Claims for Additional Time. If the Contractor wishes to make Claim for an increase in the Contract Time, the Contractor shall comply with the requirements set forth in Article 13.

G. Nothing contained in the Contract Documents shall relieve a Contractor from compliance with any statutory requirement, including, but not limited to those contained in Education Law Section 3813.

## **ARTICLE 19 MISCELLANEOUS PROVISIONS**

A. The agreement between the Owner and the Contractor shall be governed by the law of the place where the project is located; venue to be in the County in which the project is located.

B. Historical lack of enforcement of any law, local or otherwise, shall not constitute a waiver of Contractor's responsibility for compliance with such law in a manner consistent with its agreement with the Owner unless and until the Contractor has received written consent for the waiver of such compliance from the Owner and the Agency responsible for the enforcement of such law.

C. All notices to be given hereunder shall be in writing and may be given, served, or made (1) by depositing the same for first class mail delivery in the United States mail addressed to the authorized representative of the party to be notified; (2) by depositing the same in the United States mail addressed to the authorized representative of the party to be notified, postpaid and registered or certified with return receipt requested; (3) by depositing the same for overnight delivery (prepaid by or billed to the party giving notice) with the United States Postal Service or other nationally recognized overnight delivery service addressed to the authorized representative of the party to be notified; or (4) by delivering the same in person to the said authorized representative of such party. Notice deposited in the mail by certified mail or overnight delivery in accordance with the provisions hereof shall be effective from and after the fourth (4th) day next following the date postmarked on the envelope containing such notice, or when actually received, whichever is earlier. All notices to be given to the parties hereto shall be sent to or made at the addresses set forth hereinbelow. By giving the other parties at least seven (7) days' written notice thereof, the parties hereto shall have the right to change their respective

addresses and specify as their respective addresses for the purposes hereof any other address in the United States of America.

D. Except as expressly provided in the agreement between the Owner and the Contractor, duties and obligations imposed by such agreement and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law, or in equity or by other agreement, and such rights and remedies shall survive acceptance of the Contractor's work and/or any other termination of the Contractor's agreement with the Owner.

E. No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

F. The headings denoting the separately numbered Articles of these General Conditions are specifically set forth for reference purposes only and are not in any way to be deemed explanatory of or limiting of the contents of any paragraph or subparagraph. Furthermore, said headings are not to be deemed part of this Agreement for purposes of interpretation, litigation or as defining or limiting the rights or obligations of the parties.

G. In case any provision of this Agreement should be held to be contrary to, or invalid, under the law of any country, state or other jurisdiction, such illegality or invalidity, shall not affect in any way, any other provisions hereof, all of which shall continue, nevertheless, in full force and effect in any country, state or jurisdiction in which such provision is legal and valid.

H. The rights stated in these General Conditions and the documents which form the agreement between the Owner and the Contractor are cumulative and not in limitation of any rights of the Owner at law or in equity.

I. The Owner shall not be responsible for damages or for loss of anticipated profits on work not performed on account of any termination of the Contractor by the Owner or by virtue of the Owner's exercise of its right to take over the Contractor's work pursuant to its agreement with the Contractor.

J. The Owner shall not be liable to the Contractor for punitive damages on account of any its termination of the Contractor or any other alleged breach of the agreement between it and the Contractor and the Contractor hereby expressly waives its right to claim such damages against the Owner.

K. The Contractor hereby expressly waives any rights it may have in law or in equity to lost bonding capacity as a result of any of the actions of the Owner, the Architect or the Construction Manager taken in connection with the Contractor's work on the Project.

L. Upon determination by legal means (e.g. court action, etc.) that termination of Contractor pursuant to Article 17.A.1 was wrongful, such termination will be deemed converted to a

termination for convenience pursuant to Article 17.B.1 and Contractor's remedy for such termination shall be limited to the recovery of the payments permitted for termination for convenience as set forth in Article 17.B.1.

M. As between the Owner and Contractor:

1. Before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;
2. Between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and
3. After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to warranties provided in accordance with its agreement with the Owner, the date of any correction of work performed by the Contractor or failure to correct its work, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

N. 1. The Owner may occupy or use any completed or partially completed portion of the Contractor's work at any stage when such occupancy is authorized by public authorities having jurisdiction over the project.

2. Partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of the Contractor's work, nor does it waive the Owner's right to liquidated damages. Further such occupancy alone shall not determine when substantial completion and performance has been reached.

3. Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Contractor's work, and in order to prepare a complete punch list of omissions of materials, faulty workmanship, or any items to be repaired, torn out or replaced.

O. The Contractor agrees not to assign, transfer, convey or sublet or otherwise dispose of this Contract or his right, title and interest therein or his power to execute such Contract, to any other person, firm or corporation without the previous consent in writing of the Owner.

P. The Owner is a tax exempt organization and will take title to materials used in the Project in order to permit tax exemption.

Q. The Owner will furnish a certificate with the Owner's Tax Exemption Number to the Contractor for use in purchasing tangible personal property required for the Project.

R. This exemption shall not apply to machinery, equipment, tools, and other items purchased, leased, rented, or otherwise acquired for the Contractor's use even though the machinery, equipment, tools or other items are used either in part or entirely on the Work. This exemption shall apply only to materials fully incorporated into the Work of the Contract as accepted and approved by the Architect.

S. The Contractor shall, upon request by the Owner, furnish a bill of sale or other instrument indicating the quantities and types of materials purchased directly by the Contractor or subcontractor for incorporation into the Work. Upon delivery of the materials to the site, the Contractor shall mark or otherwise identify the materials to be incorporated into the Work. This exemption shall apply only to materials so identified and accepted.

***END OF GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION***

**REQUISITION FOR PARTIAL PAYMENT – WAIVER OF LIEN**

<b>PROJECT</b>	<b>OWNER</b>
<b>GENERAL CONTRACTOR</b>	<b>SUB-CONTRACTOR/VENDOR</b>
<b>CONTRACT</b>	<b>WORK COMPLETE</b>
PROJECT:	CONTRACT - \$
TRADE:	CHANGE ORDERS - \$
CONTRACT - \$	TOTAL COMPLETE - \$
CHANGE ORDERS - \$	RETAINAGE (    %) - \$
TOTAL CONTRACT - \$	LESS PRE. REQ. - \$
	THIS REQUISITION - \$

**Waiver of Lien**

The undersigned, upon receipt of the above requisition payment hereby releases and discharges the Owner of and from any liability or obligation in any way related to or arising out of this project up to and including the date of this document.

The undersigned further covenants and agrees that it shall not in any way claim or file a mechanic's or other lien against the premises of the above designated project, or any part thereof, or against any fund applicable thereto for any of the work, labor, or materials heretofore furnished by it in connection with the improvement of said premises.

The undersigned further warrants that, in order to induce the Owner to release this partial payment, they have paid all claims for labor, material, insurance, taxes, equipment, etc., employed in the prosecution of the work above, to date of this requisition.

The undersigned hereby releases and agrees to hold the Owner harmless from any and all claims in connection with the furnishing of such labor and materials, etc., for the construction of the aforementioned project.

The undersigned further guarantees that all portions of the work furnished and/or provided by them are in accordance with the Contract and that the terms of the Contract with respect to these guarantees will hold for the period specified in said Contract.

IN WITNESS WHEREOF, we have executed under seal this release on the above date and to be legally bound hereby:

WITNESS: \_\_\_\_\_ FIRM: \_\_\_\_\_

BY: \_\_\_\_\_

**CORPORATE ACKNOWLEDGEMENT**

State of

) SS.

)

County of

On the \_\_\_\_\_ day of \_\_\_\_\_, before me came \_\_\_\_\_ to me known and who by me being duly sworn did depose and say that s/he resides at \_\_\_\_\_; that s/he is the officer of the said corporation executing the foregoing instrument, that s/he knows the seal of said corporation, that the seal affixed to said instrument is such corporate seal, that it was so affixed by order of the Board of Directors of said corporation and that s/he signed her/his name thereto by like order.

\_\_\_\_\_  
Notary Public

**INDIVIDUAL ACKNOWLEDGEMENT**

State of

) SS.

)

County of

On the \_\_\_\_\_ day of \_\_\_\_\_, before me came \_\_\_\_\_ to me known and who by me being duly sworn did depose and say that s/he resides at \_\_\_\_\_; that s/he is the individual who executed the foregoing instrument.

\_\_\_\_\_  
Notary Public

**PARTNERSHIP ACKNOWLEDGEMENT**

State of

) SS.

)

County of

On the \_\_\_\_\_ day of \_\_\_\_\_, before me came \_\_\_\_\_ to me known and who by me being duly sworn did depose and say that s/he resides at \_\_\_\_\_; that s/he is the partner in the firm of \_\_\_\_\_ doing business under the name of \_\_\_\_\_ and that s/he executed the foregoing instrument on behalf of said partnership.

\_\_\_\_\_  
Notary Public

## PAYROLL

(For Contractor's Optional Use; See Instructions at [www.dol.gov/whd/forms/wh347instr.htm](http://www.dol.gov/whd/forms/wh347instr.htm))

**Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.**

NAME OF CONTRACTOR <input type="checkbox"/>		OR SUBCONTRACTOR <input type="checkbox"/>	ADDRESS	OMB No.: 1235-0008 Expires: 01/31/2015
PAYROLL NO.		FOR WEEK ENDING		

(1) NAME AND INDIVIDUAL IDENTIFYING NUMBER (e.g., LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER) OF WORKER	(2) NO. OF WITH-HOLDING EXEMPTIONS	(3) WORK CLASSIFICATION	(4) DAY AND DATE							(5) TOTAL HOURS	(6) RATE OF PAY	(7) GROSS AMOUNT EARNED	(8) DEDUCTIONS					(9) NET WAGES PAID FOR WEEK	
			(4) DAY AND DATE										FICA	WITH- HOLDING TAX	OTHER	TOTAL DEDUCTIONS			

While completion of Form WH-347 is optional, it is mandatory for covered contractors performing work on Federally financed or assisted construction contracts to respond to the information collection contained in 28 C.F.R. §§ 3.3, 5.5(e). The Copeland Act (20 U.S.C. § 3145) contractors performing work on Federally financed or assisted construction contracts to "submit weekly a statement with respect to the wages paid each employee during the preceding week." U.S. Department of Labor (DOL) regulations at 29 C.F.R. § 5.5(a)(3)(ii) require contractors to submit weekly a copy of all payrolls to the Federal agency contracting for or financing the construction project, accompanied by a signed "Statement of Compliance" indicating that the payrolls are correct and complete and that each laborer or mechanic has been paid not less than the proper Davis-Bacon prevailing wage rate for the work performed. DOL and federal contracting agencies receiving this information review the information to determine that employees have received legally required wages and fringe benefits.

### Public Burden Statement

We estimate that it will take an average of 55 minutes to complete this collection, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W., Washington, D.C. 20210

**(over)**

Date \_\_\_\_\_

I, \_\_\_\_\_ (Name of Signatory Party) \_\_\_\_\_ (Title)

do hereby state:

(1) That I pay or supervise the payment of the persons employed by

\_\_\_\_\_ (Contractor or Subcontractor) \_\_\_\_\_ on the

\_\_\_\_\_ (Building or Work) \_\_\_\_\_; that during the payroll period commencing on the

\_\_\_\_\_ day of \_\_\_\_\_, and ending the \_\_\_\_\_ day of \_\_\_\_\_, all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said

\_\_\_\_\_ (Contractor or Subcontractor) \_\_\_\_\_ from the full

weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 (29 C.F.R. Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Stat. 108, 72 Stat. 967, 76 Stat. 357, 40 U.S.C. § 3145), and described below:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, or if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

☐ -- in addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ -- Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

REMARKS:

NAME AND TITLE	SIGNATURE

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 231 OF TITLE 31 OF THE UNITED STATES CODE.



## SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

### PART 1 - GENERAL

#### 1.1 PROJECT INFORMATION

- A. Project: Mt Pleasant School District – New Maintenance Building
- B. Project Location: Mt Pleasant, NY
- C. Owner: Mt Pleasant School District
- D. Architect: LAN Associates
- E. Construction Manager: Arris Contracting Company, Inc.
- F. The overall scope of work includes: Sitework , concrete foundation, Engineered Metal Building, doors, ceilings, finishes, etc., Electrical, Mechanical, and Plumbing work.

The contractor shall provide all labor, materials, equipment and services to furnish deliver and install all materials and related work as shown on the drawings, as required by these specifications and/or as directed by the Architect/Construction Manager.

#### G. Contracts:

- 1. The Project will be constructed under a multiple prime-contracting arrangement.
- 2. Prime Contacts are separate contracts between the Owner and separate contractors, representing significant construction activities. Each prime contact is performed concurrently with and closely coordinated with construction activities performed on the Project under other prime contracts. Prime contracts for this Project include.

- a. General Work Contract. (GC or GWC)
- b. HVAC Contract. (MC, HVAC or HC)
- c. Electrical Contract. (EC)
- d. Plumbing Contract ( PC )

#### 1.2 DIVISION OF WORK

- A. Each contract shall include all labor materials, plans, tools, equipment and supervision which are required for or incidental to the proper completion of the work as indicated on the drawings and described in the following specification sections:

#### 1.3 GENERAL REQUIREMENTS – ALL CONTRACTS

##### DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

00 01 15	List of Drawings
00 10 00	Notice to Bidders
00 21 00	Instructions to Bidders
00 40 00	Sexual Harassment Prevention Certification Form
00 41 01	Forms to Be Submitted with Bid
00 41 02	Bid Proposal Form
00 41 16	Bid Form for General Contractor
00 41 16	Bid Form for Mechanical Contractor
00 41 16	Bid Form for Electrical Contractor
00 41 16	Bid Form for Plumbing Contractor
00 43 90	Surety's Consent
00 43 91	Certificate of Bidder

SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

00 43 92	Qualifications of Bidders
00 43 93	Statement of Bidders Qualifications
00 43 94	Bidder's Personnel
00 43 95	Conflict of Interest Certificate
00 43 96	Form of Disclosure Certificate
00 43 97	Non-Collusion Affidavit
00 43 98	Certification of Compliance with the Iran Divestment Act
00 43 99	Declaration of Bidder's Inability to Provide Certification of Compliance with the Iran Divestment Act
00 45 03	Insurance Certification Form
00 45 21	Hold Harmless Agreement
00 46 43	Wage Rates
00 50 00	Owner Contractor Agreement
00 61 00	Bond Requirements
00 61 01	Bid Bond Form AIA 310-2010
00 61 02	Performance Bond Form AIA 312-2010
00 61 03	Payment Bond Form AIA 312-2010
00 63 00	Request for Information
00 63 01	RFI Form AIA G716-2004
00 70 00	General Conditions of the Contract for Construction
00 70 01	Partial Waiver of Liens
00 70 02	Certified Payroll

**DIVISION 01 – GENERAL REQUIREMENTS**

01 10 00	Summary of Work
01 11 00	Milestone Schedule
01 21 00	Allowances
01 22 00	Unit Prices
01 23 00	Alternates
01 25 00	Substitution Procedures
01 26 00	Contract Modification Procedures
01 29 00	Payment Procedures
01 31 00	Project Management and Coordination
01 31 50	COVID-19 Contractor Procedures
01 32 16	Construction Progress Schedule
01 32 33	Photographic Documentation
01 33 00	Submittal Procedures
01 40 00	Quality Requirements
01 45 33	Code-Required Special Inspections
01 50 00	Temporary Facilities and Controls
01 60 00	Product Requirements
01 73 00	Execution Requirements
01 73 10	Cutting and Patching
01 74 19	Construction Waste Management and Disposal
01 74 23	Cleaning Up
01 77 00	Close-Out Procedures
01 77 01	Closeout Checklist
01 78 23	Operation and Maintenance Data
01 78 39	Project Record Documents

SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

01 91 13 General Commissioning Requirements

**CONTRACT #1 – GENERAL WORK CONTRACTOR**

**In addition to the General Requirements, Division 1, included in this bid package shall provide for proper completion of work as indicated on all drawings and in accordance with the terms and conditions described in the following specification sections.**

**DIVISION 3 - CONCRETE**

033000 – CAST IN PLACE CONCRETE  
035400 – CONCRETE UNDERLAYMENT PATCH  
035416 – CEMENT-BASED, INTERIOR, SELF-LEVELING UNDERLAYMENT

**DIVISION 5 – METALS**

054000 – COLD FORM STEEL FRAMING

**DIVISION 6 – WOOD AND PLASTICS**

061000 – ROUGH CARPENTRY  
066116 – SOLID SURFACING FABRICATIONS

**DIVISION 7 – THERMAL AND MOISTURE PROTECTION**

072100 – BUILDING INSULATION  
078443 – FIRESTOPPING  
079200 – JOINT SEALANTS

**DIVISION 8 - OPENINGS**

081113 – HOLLOW METAL DOORS AND FRAMES  
083113 - ACCESS DOORS AND FRAMES  
083600 – SECTIONAL OVERHEAD DOORS  
085113 – ALUMINUM WINDOWS  
087100 – DOOR HARDWARE  
088100 – GLASS AND GLAZING

**DIVISION 9 - FINISHES**

090561 – WATER VAPOR EMISSION CONTROL SYSTEM FOR CONCRETE SLABS  
092900 – GYPSUM BOARD  
095113 – ACOUSTIC TILE CEILINGS  
096513 – RESILIENT BASE AND ACCESSORIES  
096723 – RESINOUS FLOORING  
099123 – INTERIOR PAINTING

**DIVISION 12 - FURNISHINGS**

123554 – MANUFACTURED CASEWORK

**DIVISION 13 – METAL BUILDING SYSTEMS**

133419 – METAL BUILDING SYSTEMS

SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

**DIVISION 31 – EARTHWORK**

311000 – SITE CLEARING  
312001 – EARTHWORK  
312318 – SITE TRENCHING  
312319 – DEWATERING  
313117 – SOIL CONSERVATION  
315000 – EXCAVATION SUPPORT & PROTECTION

**DIVISION 32 – EXTERIOR IMPROVEMENTS**

321313 – BITUMINOUS CONCRETE PAVING  
321613 - CONCRETE CURBING  
321614 – CONCRETE SITE WORK  
321723 – PAVEMENT MARKINGS  
329200 – LAWNS AND GRASSES  
329300 – LANDSCAPING

**DIVISION 33 – UTILITIES**

330500 – COMMON WORK RESULTS FOR UTILITIES  
334100 – STORM DRAINAGE  
334600 – SUBDRAINAGE  
334611 – BIORETENTION AND DRY SWALE

Special Notes: Contract #1 – General Work Contractor:

1. General Work Contractor to carry insurance coverages per Article 11 in the General Conditions of the Contract for Construction which are located in the DIV O specification.
2. Work hours M-F 7:00AM – 4:30PM. Contractor will appropriately man the project to avoid Saturday and Overtime hours which result in Owner, Construction Manager and Architect additional costs.
3. Access doors furnished by trade requiring access; installation by Contract #1 – General Work Contractor.
4. GC will confirm compatibility in writing between his concrete and any floor self-leveling or patching materials with the resinous floor manufacturer.
5. GC is responsible for all underground site storm piping , structures, bioretention, etc. ( Excavation and backfill for site domestic water piping is by Plumbing Contractor and site electrical is by Electrical Contractor ).
6. All staging area work (signage, parking areas, fence enclosures, etc.) indicated for staging area (described in section 015000) is by GC. Remove all temporary materials and restore all temporary roadways / staging surfaces at conclusion of the project.
7. GC will install floor protections (utilizing heavy duty “Ram-Board” with taped joints, or equivalent) to protect finished floor surfaces from damage for all areas until final turnover to the owner.

## SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

8. Contractor is specifically reminded about their responsibilities for clean-up as per section 017423. Maintaining a clean jobsite is considered a safety issue and will be strictly enforced. In addition to daily cleaning, the contractor is required to hire a professional cleaning company to final clean all areas impacted by the construction. This includes completely cleaning any surfaces/equipment/furniture which has been dusted by the construction work. If the contractor does not properly perform this function when directed by the Owner/CM, the owner will perform the work with others and deduct the cost from the contractor.

### 1.4 CONTRACT #2 – MECHANICAL CONTRACTOR

**In addition to the General Requirements, Division 1, each Contract included in this bid package shall provide for proper completion of work as indicated on all drawings and in accordance with the terms and conditions described in the following specification sections.**

#### **DIVISION 6 – WOOD AND PLASTICS**

061000 – ROUGH CARPENTRY ( for any MC related blocking )

#### **DIVISION 7 – THERMAL AND MOISTURE PROTECTION**

078443 – FIRESTOPPING  
079200 – JOINT SEALANTS

#### **DIVISION 8 - OPENINGS**

083113 - ACCESS DOORS AND FRAMES  
089000 – LOUVERS AND VENTS

#### **DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING**

230000 – MECHANICAL SUMMARY OF WORK  
230500 – COMMON WORK RESULTS FOR HVAC  
230513 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT  
230529 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT  
230553 – MECHANICAL IDENTIFICATION  
230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC  
230719 – PIPING INSULATION  
230993 – SEQUENCE OF OPERATIONS FOR HVAC CONTROLS  
232300 – REFRIGERANT PIPING  
233113 – METAL DUCTS  
233300 – AIR DUCT ACCESSORIES  
233416 – CENTRIFUGAL HVAC FANS  
233713 – DIFFUSERS, REGISTERS AND GRILLES  
238126 – SPLIT-SYSTEM AIR-CONDITIONERS  
238236 - FINNED TUBE RADIATION HEATERS

#### **DIVISION 26 – ELECTRICAL**

260523 - CONTROL-VOLTAGE ELECTRIC POWER CABLES ( for HVAC control wiring)

Special Notes: Contract #2 – Mechanical (MC) Contractor:

## SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

1. Mechanical Contractor to carry insurance coverages per Article 11 in the General Conditions of the Contract for Construction which are located in the DIV O specification.
2. Work hours M-F 7:00AM – 4:30PM. Contractor will appropriately man the project to avoid Saturday and Overtime hours which result in Owner, Construction Manager and Architect additional costs.
3. Access doors are furnished by MC Contract # 2 and installed by GC Contract #1.
4. All new HVAC curbs / collars to be supplied and installed by MC Contract #2. This includes wall hole cut, wood blocking, watertight secure of opening.
5. Any wood blocking for MC items by Contract #2 MC.
6. Any reinforcing associated with Mechanical work is by MC Contract # 2. This includes any steel angle supports for suspended or wall mounted HVAC units.
7. VFD's, disconnects, starters, etc. supplied by MC will be installed by EC, unless noted otherwise.
8. MC Contract # 2 is responsible for making their own through wall and through floor duct/piping penetrations and associated patching/fire-stopping.
9. If any new mechanical units are too large to fit through existing openings the Mechanical contractor will either disassemble equipment into sections or remove existing construction to enlarge opening and reconstruct to match (at no additional cost).
10. Duct detectors supplied and wired by EC (MC installs the duct detector)
11. Contractor is specifically reminded about their responsibilities for clean-up as per section 017423. Maintaining a clean jobsite is considered a safety issue and will be strictly enforced. In addition to daily cleaning, the contractor is required to hire a professional cleaning company to final clean all areas impacted by the construction. This includes completely cleaning any surfaces/equipment/furniture which has been dusted by the construction work. If the contractor does not properly perform this function when directed by the Owner/CM, the owner will perform the work with others and deduct the cost from the contractor.

### 1.5 CONTRACT #3 – ELECTRICAL

**In addition to the General Requirements, Division 1, each Contract included in this bid package shall provide for proper completion of work as indicated on all drawings and in accordance with the terms and conditions described in the following specification sections.**

#### **DIVISION 7 – THERMAL AND MOISTURE PROTECTION**

078443 - FIRESTOPPING

#### **DIVISION 8 - OPENINGS**

083113 - ACCESS DOORS AND FRAMES

SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

**DIVISION 26 - ELECTRICAL**

260500 – COMMON WORK RESULTS FOR ELECTRICAL  
260519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES  
260523 – CONTROL VOLTAGE ELECTRICAL POWER CABLES  
260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS  
260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS  
260532 – INTERIOR RACEWAYS FITTINGS AND ACCESSORIES  
260533 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS  
260534 – ELECTRICAL IDENTIFICATION  
260543 – UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS  
260544 – SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLE  
260548 – SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS  
260563 – EQUIPMENT CONNECTIONS AND COORDINATION  
260800 – ELECTRICAL SYSTEMS COMMISSIONING  
262413 – SWITCHBOARDS  
262416 - PANELBOARDS  
262726 – WIRING DEVICES  
262812 – SAFETY SWITCHES  
262813 - FUSES  
262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS  
265100 – LIGHTING  
265119 – LED INTERIOR LIGHTING  
265600 – EXTERIOR LIGHTING

**DIVISION 27 - COMMUNICATIONS**

270000 – COMMUNICATION  
270500 – COMMON WORK RESULTS FOR COMMUNICATIONS  
270526 – GROUNDING AND BONDING FOR COMMUNICATIONS  
270528 – PATHWAYS FOR COMMUNICATIONS SYSTEMS  
271000 – STRUCTURED CABLING  
271100 – COMMUNICATIONS EQUIPMENT ROOM FITTINGS  
271300 – COMMUNICATIONS BACKBONE CABLING  
271400 – FIBER OPTIC CABLE AND EQUIPMENT  
271500 – COMMUNICATIONS HORIZONTAL CABLING  
272000 – DATA COMMUNICATIONS  
272100 – DATA COMMUNICATIONS NETWORK EQUIPMENT  
272102 – DATA SYSTEMS  
276600 – COMMUNICATIONS EQUIPMENT ROOMS AND FITTINGS

**DIVISION 28 – ELECTRONIC SAFETY AND SECURITY**

280513 – CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY  
283111 – DIGITAL, ADDRESSABLE FIRE ALARM SYSTEM

**DIVISION 31 – EARTHWORK**

312318 – SITE TRENCHING  
312319 – DEWATERING  
315000 – EXCAVATION SUPPORT & PROTECTION

**DIVISION 33 – UTILITIES**

## SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

### 330500 – COMMON WORK RESULTS FOR UTILITIES

#### Special Notes: Contract #3 – Electrical Contract

1. Electrical Contractor to carry insurance coverages per Article 11 in the General Conditions of the Contract for Construction which are located in the DIV O specification.
2. Work hours M-F 7:00AM – 4:30PM. Contractor will appropriately man the project to avoid Saturday and Overtime hours which result in Owner, Construction Manager and Architect additional costs.
3. Access doors are furnished by Electrical Contract #3 and installed by GC Contract #1.
4. VFD's, disconnects, motor starters, etc. which are supplied by MC will be installed by EC, unless noted otherwise.
5. Any wood blocking or panel backboards for electrical items by EC contract #3
6. EC is responsible for all excavation and backfill for their own work items. Power feeds, site lighting , etc.
7. For Plumbers flushometers: the EC will install the PC provided transformer above the ceiling and install the wire to in-wall box. The EC then makes the wire connection from the electrical in -wall box to the flushometer.
8. Any Solenoid valves supplied & installed by PC – wiring and connections by EC
9. EC to provide and wire duct detectors (MC install the duct detector)
10. Contractor is specifically reminded about their responsibilities for clean-up as per section 017423. Maintaining a clean jobsite is considered a safety issue and will be strictly enforced. In addition to daily cleaning, the contractor is required to hire a professional cleaning company to final clean all areas impacted by the construction. This includes completely cleaning any surfaces/equipment/furniture which has been dusted by the construction work. If the contractor does not properly perform this function when directed by the Owner/CM, the owner will perform the work with others and deduct the cost from the contractor.

### 1.6 CONTRACT #2 – PLUMBING CONTRACTOR

In addition to the General Requirements, Division 1, included in this Plumbers bid package shall provide for proper completion of work as indicated on all drawings and in accordance with the terms and conditions described in the following specification sections.

#### DIVISION 7 – THERMAL AND MOISTURE PROTECTION

078443 – FIRESTOPPING

079200 – JOINT SEALANTS

#### DIVISION 8 - OPENINGS

083113 - ACCESS DOORS AND FRAMES



SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

**DIVISION 22 - PLUMBING**

220000 – PLUMBING SUMMARY OF WORK  
220501 – BASIC PLUMBING MATERIALS AND METHODS  
220517 – SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING  
220518 – ESCUTCHEONS FOR PLUMBING PIPING  
220519 – METERS AND GAGES FOR PLUMBING PIPING  
220523 – VALVES  
220529 – HANGERS AND SUPPORTS FOR PLUMBING AND PIPING EQUIPMENT  
220548 – VIBRATION CONTROLS  
220553 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT  
220719 – PLUMBING PIPING INSULATION  
221116 – DOMESTIC WATER PIPING  
221119 – DOMESTIC WATER PIPING SPECIALTIES  
221316 – SANITARY WASTE AND VENT PIPING  
221319 – SANITARY WASTE PIPING SPECIALTIES  
223300 – ELECTRIC DOMESTIC WATER HEATERS  
224100 – PLUMBING FIXTURES  
224213 – COMMERCIAL WATER CLOSETS

**DIVISION 31 – EARTHWORK**

312318 – SITE TRENCHING  
312319 – DEWATERING  
315000 – EXCAVATION SUPPORT & PROTECTION

**DIVISION 33 – UTILITIES**

330500 – COMMON WORK RESULTS FOR UTILITIES  
331116 – SITE WATER UTILITY DISTRIBUTION PIPING  
333100 – SANITARY UTILITY SEWERAGE PIPING  
333100 – SANITARY UTILITY SEWERAGE STRUCTURES

Special Notes: Contract # 4 – Plumbing Contract.

1. Plumbing Contractor to carry insurance coverages per Article 11 in the General Conditions of the Contract for Construction which are located in the DIV O specification.
2. Work hours M-F 7:00AM – 4:30PM. Contractor will appropriately man the project to avoid Saturday and Overtime hours which result in Owner, Construction Manager and Architect additional costs.

## SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

3. Access doors for plumbing items by PC; installation by Contract #1 – General Work Contractor.
4. All sanitary piping and water distribution piping work is by Plumbing contract whether located subslab or exterior. All excavation, backfill and compaction for plumbing piping ( interior / exterior ) is by Plumbing Contract # 4.
5. PC provides and installs Flushometers and drills holes for electrical conduit. PC supplies the associated transformer to the EC. All wiring by EC.
6. Any Solenoid valves supplied & installed by PC (wiring and connections by EC)
7. PC is responsible for making their own through wall, through floor/roof piping penetrations and associated patching/fire-stopping.
8. Contractor is specifically reminded about their responsibilities for clean-up as per section 017423. Maintaining a clean jobsite is considered a safety issue and will be strictly enforced. In addition to daily cleaning, the contractor is required to hire a professional cleaning company to final clean all areas impacted by the construction. This includes completely cleaning any surfaces/equipment/furniture which has been dusted by the construction work. If the contractor does not properly perform this function when directed by the Owner/CM, the owner will perform the work with others and deduct the cost from the contractor.

### 1.7 PRIME CONTRACTOR'S USE OF PREMISES

Use of the Site: Limit use of the premises to work in areas indicated. Confine operations areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the work is indicated.

Owner Occupancy: Allow for Owner occupancy, work by other owner contractors and use by the public.

Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

Delivery blackout times – No contractor trucks / deliveries are allowed during school bus times 8:00AM – 9:30AM or 2:00PM – 3:30PM.

Existing building spaces may not be used for storage unless approved by the CM and Owner.

Time Restrictions: Working hours M-F 7:00AM – 4:30PM.

Owner's representative(s) will cover the project for the standard 8-hour Monday-Friday shift. If contractor requests additional hours to make up schedule time or weekends, he will need to reimburse owner for any additional coverage or costs (e.g. – Architect, Construction Manager, Custodian, and Security) at their contractual rate.

## SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

No contractor work will be allowed during testing / ELA/ regents time periods. No additional costs to owner for not working during these testing times. Exact dates are not known at this time, contractor shall figure 8 days.

Contractors shall comply with Local Noise Ordinance. Work disrupting the community must be performed with the following hours:

General: Limitations on site usage as well as specific requirements that impact utilization are indicated on the drawings and by other contract documents. In addition to these limitations and requirements, the Contractor shall administer allocation of available space equitably among the separate sub contractors and other entities needing access and space, so as to produce the best overall efficiency in performance of the total work of the project. The Contractor shall schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.

Only materials and equipment, which are to be used directly in the work, shall be brought to and stored on the project site by the Contractor. After equipment is no longer required for the work, it shall be promptly removed from the project site. Protection of construction materials and equipment stored at the project site from weather, theft, damage and all other adversity is solely the responsibility of the Contractors.

Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas indicated. If additional storage is necessary, obtain and pay for such storage off-site.

The Contractor(s) and any entity for which the Contractor is responsible shall not erect any sign of the Project site without the prior written consent of the Owner, which may be withheld in the sole discretion of the Owner.

Contractor shall ensure that the work, at all times, is performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the work and all adjacent areas. The work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the work shall be free from all debris, building materials and equipment likely to cause hazardous conditions. Without limitation of any other provision of the Contract Documents, contractor shall use its best efforts to minimize any interference with the occupancy or beneficial use of: Any areas and buildings adjacent to the site of the work or; The Building in the event of partial occupancy.

Without prior approval of the Owner, the Contractor shall not permit any workers to use any existing facilities at the Project site, including, without limitations, lavatories, toilets, entrances and parking areas other than those designated by the Owner. Without limitation of any other provision of the Contract Documents, the Contractor shall use its best efforts to comply with the rules and regulations promulgated by the Owner in connection with the use and occupancy of the Project Site, and the Building, as amended from time to time. The Contractor shall immediately notify the Owner in writing if during the performance of the Work, the Contractor finds compliance with any portion of such rules and regulations to be impracticable, setting forth the problems of such compliance and suggesting alternatives through which the same results intended by such portions of the rules and regulations can be achieved. The Owner may, in the Owner's sole discretion, adopt such suggestions, develop new alternatives or require compliance with the existing requirements of the rules and regulations. The Contractor shall also comply with all insurance requirements, applicable to use, and occupancy of the Project Site and the Building.

## SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

Maintain the existing building in a safe and weathertight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period. When work is scheduled after hours clean and remove all temporary barriers and protection so that the building can be occupied the following day when normal building occupancy will occur.

Each Prime contractor is responsible for maintaining a safe jobsite. This include actively reviewing their work areas to ensure that they are in compliance with all required OSHA regulations. It is a contract requirement that each contractor conducts weekly tool-box safety meetings to insure that their employees are properly educated and utilizing safe work practices. (Copies of these weekly meetings and a list of the attendees will be forwarded to the CM site superintendent on a weekly basis). Contractors will comply with all requirements outlined in Article 7 of the General Conditions including providing their employees with PPE (personal protective equipment), such as hard hats, proper work boots, safety harness, safety glasses, etc.

Keep public areas such as hallways, stairs, elevator lobbies and toilet rooms free from accumulation of waste material, rubbish or construction debris.

Smoking, drinking of alcoholic beverages or open fires will not be permitted on the project site.

Utility Outages and Shutdown:

- a. Limit disruption of utility services to hours the building is unoccupied, weekends or holidays at no additional cost.
- b. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Mt Pleasant Central School District and authorities having jurisdiction.
- c. Prevent accidental disruption of utility services to other facilities.
- d. All costs for manning of temporary shutdowns and utility crossovers, including 24-hour fire watch if necessary, is included in the contractor's bid regardless of weekend, holiday, etc.

### 1.8 OCCUPANCY REQUIREMENTS

Full Owner Occupancy: The Owner will occupy the site and existing building during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with the Owner's operations.

Partial owner Occupancy: The Owner reserves the right to occupy the place and install equipment in completed areas of the work prior to Substantial Completion, provided such occupancy does not interfere with completion of the Work, Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.

The Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner occupancy.

Obtain a Certificate of Occupancy from local building officials prior to Owner occupancy.

Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Owner will operate and maintain mechanical and electrical systems serving occupied portions of the building.

## SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

Upon occupancy, the Owner will assume responsibility for maintenance and custodial service for occupied portions of the building.

### 1.9 PRODUCTS ORDERED IN ADVANCE

None

### 1.10 DEFINITIONS

Definitions as applied to “Contractors” involved with the work of this Project:

“The Contractor” or “Contractor” meaning that Respective Prime Contractor normally responsible for that work referenced;

“Respective Prime Contractor” meaning either the – General Contractor, Plumbing, HVAC or Electrical Contractors normally responsible for the referenced work;

“Trade Contractor” meaning that Respective Prime Contractor as above; and such other terms relating to Contractors to be taken in context with respect to referenced work.

Further, wherein said Division 0 and 1 and respective Sections therein, any reference is made to “General Contractor”, same shall be construed to mean “Contractor for the General Construction, or General Work Contractor”.

The Architect cannot guarantee the correctness of the existing conditions shown and assumes no responsibility therefore, it shall be the responsibility of the Contractor to visit the site and verify all existing conditions prior to bid.

The Owner will purchase certain items required for the overall operation of this facility.

The Contractor(s) will cooperate with said vendors as may be necessary to permit the work to be accomplished.

- a. The cooperation may extend to the receiving, unloading and placement of said equipment if directed by the Owner.
- b. Terms of payment, if any, shall be in accordance with the General Conditions as amended or modified.
- c. Each Contractor is advised that the Owner may enter into separate contracts as may be in their best interest.
- d. Each Contractor is further advised that there will be a full on-site Project Representative / Construction Manager, whose duties will be defined at the pre-construction meeting.

#### ADDITIONAL SECURITY PROVISIONS.

1. All Contractors’ employees shall use a single means of access and egress, except in the case of emergency, to be designated by the Construction Manager.
2. Each Contractor and each Subcontractor shall require his employees, while on the job site, to wear, in a conspicuous location, a photo I.D. button bearing the name of the employee and the Contractor. The buttons of each Contractor shall be numbered consecutively. An up-to-date list of all I.D. buttons, indicating the name and number for each employee, shall be furnished to the Construction Manager.

**1.12 ASBESTOS AND LEAD PAINT AWARENESS REQUIREMENTS**

Contractor agrees not to use or permit the use of any asbestos containing material in or on any property belonging to the Owner.

For purposes of this requirement, asbestos free shall mean free from all forms of asbestos, including - actinolite, amosite, anthrophyllite, chrysotile, cricidolite and tremolite, both in friable and non-friable states and without regard to the purposes for which such material is used.

**1.13 CONSTRUCTION TIME AND PHASING REQUIREMENTS**

Each Contractor is advised the “time is of the essence” of the Contract as defined in Article 13 of the “General Conditions” for the completion of the construction of the facility.

It is understood that the work is to be carried through to completion with the utmost speed consistent with good workmanship.

Time of Completion shall be as established in the Milestone Schedules (Section 011100).

Further, safe and legal ingress and egress shall be maintained at all times to and through the occupied portions of the construction site.

Work shall proceed in such a manner as to cause the least amount of disruption to the ongoing operations as possible.

**COORDINATE CLOSELY WITH SCHOOL OPERATING PERSONNEL.**

All work and storage areas shall be completely enclosed by a fence or barricade at all times so that no student or the public can approach the area or the equipment.

The Contractor shall maintain fences and barricades at all times and shall repair/ restore and/ or pay for any temporary fencing damaged by their work.

Maintain at all times, all exits and walkways.

Where the barricade is removed for work, the Contractor performing such work shall provide adequate safety personnel to prevent unauthorized persons from approaching the work area.

**Construction Phasing**

The phasing and/ or milestone schedule contained in Section 011100 has been established for the overall construction of the project.

Each Contractor is advised that areas of the existing buildings which are to be added to and / or altered under this Contract will remain in use during construction, coordinate with Section 015000 for temporary facilities.

Electrical and mechanical services to the functioning spaces shall be maintained at all times.

Swing-overs to new facilities shall be made so as to cause the least interruption to the facilities' operations.

The Contractor shall provide and maintain all required separations between old and new construction to prevent: Unauthorized entrance to construction areas by others than Architect, Construction Manager or Owner , heat loss from existing building , water ( rain or ground ) infiltration into existing building.

## SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

Exterior alteration and restoration, as required, may proceed outside of phasing schedule at the Contractor's option with concurrence from the Architect, Construction Manager and Owner.

Site development work shall proceed in such a manner to cause the least amount of disruption to the ongoing operations as possible.

### **1.14 PROOF OF ORDERS AND DELIVERY DATES - Coordinate with Sections 013300 and 013216.**

Within 2 weeks after the approval of shop drawings, samples, product data and the like, the Contractor shall provide copies of purchase orders for all equipment and materials which are not available in local stock. The Contractor shall submit written statements from suppliers confirming the orders and stating promised delivery dates. Failure to provide this critical information will result in Owner holding monthly requisition payments until received.

**Due to COVID-19 and it's potential to disrupt material supply-chains, the contractors are required to obtain all materials for the project and store them onsite in their individual Conex boxes. This includes general material items typically readily available (piping, conduits, wire, metal studs, ceiling, etc.). The owner will pay for these stored items delivered to the jobsite in accordance Section 012900.**

This information shall be incorporated within the progress schedules so required as part of Section 013216 and 013300 and shall be monitored so as to ensure compliance with promised dates.

INTENT OF DOCUMENTS – See General Conditions for resolution of conflicts between drawings and specifications.

In the event of conflict, ambiguity and/or unclear circumstances between any of the requirements of the Contract Documents, the requirement that is most inclusive and of highest quality, quantity, and/or cost shall govern. The Contractor shall (1) provide the better quality or greater quantity of Work and/or (2) comply with the more stringent requirement; either or both in accordance with the Architect's interpretation. The Contractor herewith agrees that no extra compensation shall be awarded to him based upon a claim of conflict, ambiguity or unclear circumstances in the Contract Documents. See the General Conditions for greater detail.

### **1.15 FIELD MEASUREMENTS**

Each Respective Contractor shall take all necessary field measurements prior to fabrication and installation of work and shall assume complete responsibility for accuracy of same.

This project is an ALTERATION and therefore necessitates additional attention to existing conditions receiving newly fabricated and installed equipment, i.e. note the requirements for field dimensioning of shop fabricated items whether or not so required by each technical section.

### **1.16 INITIAL SUBMITTAL REQUIREMENTS**

As outlined in Division 01, each Contractor shall provide items noted including - bonds, insurance, emergency telephone numbers, progress scheduling, schedules of submittals, subcontractor listings and the like prior to the start of any work. The owner will not issue contracts until all bonds and insurance information is received by the contractor and verified correct.

## SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

### 1.17 SCHEDULES

The milestone schedule presented in the documents is for bidding and general purposes. Due to the nature of the work, it is the intention of the Construction Manager to negotiate actual work periods for the project among the various Prime Contractors involved with this bidding process, as well as separate contractors involved with other phases of the work solicited under separate proposals. Each Contractor shall, under terms of the General Conditions, mutually cooperate in the rescheduling of work to permit an uninterrupted use of the facilities by the Owner, without additional cost to the Owner.

General:

1. The objective of this project is to complete the overall work in the shortest period of time and to protect the building and occupants from damages caused by weather and construction activity during the progress of the work.
2. To meet these objectives, the Contractor shall plan the work, obtain materials, and execute the construction in the most expeditious manner possible in accordance with the requirements listed below.
3. If the Contractor fails to expedite and pursue any part of the work, the Owner may terminate the contract as per Article 17 or may carry out the work with others per the General Conditions.
4. The Contractor shall work in coordination with work of other Contractors and with school activities with special attention to noise, dust, safety and other contract requirements for work in and around the occupied buildings.
5. All contractors are required to comply with proper sequencing of work and provide other prime contractors sufficient time to install their work (e/g/-metal stud walls get fully framed; MEP contractors perform roughing/testing/inspections; then walls are sheathed with gypsum – no sheetrocking one side unless CM approved). If contractor “boxes out” another prime contractor, he will be directed to stop work and open if necessary, to enable other trades to complete their work. No compensation for lost time due to stop-work will be provided.

Milestone Schedule (See Section 01 11 00).

### 1.18 ADDITIONAL REQUIREMENTS

The following are additional general and special requirements which will govern the work of the projects covered by these Documents.

1. If it appears that some of the work cannot be completed by the scheduled date, the Contractor shall increase the work force or increase the hours of work, including evenings and weekends as necessary, and cover any additional costs to the Owner, architect and Construction Manager.
2. If the work is complete but the area is not cleaned and debris or equipment is not removed, the Owner shall have the right to prepare the area for occupancy with his own forces and deduct the costs from the Contract Amount. (If Contractor does not respond within 4 hours notice).
3. If the Contractor fails to staff the job adequately to meet the completion date, the Owner reserves the right to assume possession of the material and complete installation with the



## SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

Owner's forces or other Contractors or to require the Contractor to work evenings and weekends at no additional cost.

4. The school can be made available on weekends and evenings to allow the Contractor adequate time to complete the work before final completion date. Any custodial or Construction Manager costs resulting in this after-hours scheduling will be the Contractor's responsibility as their contractual hourly rate.
5. In addition to the above-stated requirements for phasing of the work, the Contractors shall not do any noisy work in the areas where examinations will be conducted as per the published school calendar.
6. Work in each work period shall progress at least at a pace in proportion to the Contract time available.
7. The Contractor is responsible for temporary protection of all work until acceptance.
8. The school will be closed on Saturdays, Sundays, regularly schedules district holidays, and at night after cleaning crews have finished.
9. If any contractor wishes to work at any time when the school is normally closed, that Contractor shall arrange and pay for custodial services for the building at the applicable district pay rates.
10. All existing conditions must be verified in the field. The Owner takes no responsibility for actual conditions found deviating from the drawings. If existing condition interferes with contract work, contractor is responsible to eliminate this condition.
11. Contractor must plan, provide and maintain his own access, ramping, and egress as required into and out of the site, staging of trailer(s), materials, machinery, and equipment in agreement with the Construction Manager's Superintendent. Maintain free and safe access on the jobsite for other related project personnel. Maintain safe pedestrian or vehicular traffic must be regulated by a flagman. Trucking and delivery operation should be coordinated with Construction Manager's Superintendent and all other trades.
12. Contractor is responsible for all work shown on Contract Documents, including drawings of other trade disciplines. For example, the HVAC Contractor will be responsible for HVAC work shown on Architectural Drawings.
13. Contractor is responsible to maintain existing site fencing in its existing condition. Modifications to the fence to better accommodate the contract work can be discussed with the Construction Manager. These changes shall then be handled by this contractor at his expense and in accordance with the Construction Manager's Superintendent's direction. Any cost incurred as a result of damages shall be charged to this contractor.
14. Contractor's personnel will not be permitted to use Mt Pleasant Central School District's facilities (including toilet, telephone, food services, etc.) for their own benefit. Contractors' Superintendent must explain this to all their field forces.
15. Time is of the essence. Contractors' proposed schedule must be approved by the Construction Manager. Contractor shall indicate significant events such as submittals, shop drawings, material ordering, fabrication, delivery, coordination precedents, installation, testing and turnover by area or system as agreed with Construction Manager. A revised progress status shall be required on a weekly basis.
16. Decisions required from the Construction Manager, Architect and/or Engineer, shall be anticipated by the Contractor to provide ample time for inspection, investigation or detailed drawings.

SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

17. Contractor shall limit his operations including storage of materials and prefabrication to areas within the Contract Limit Lines unless otherwise permitted by the Construction Manager at the Owner's option.
18. Contractor shall coordinate the use of premises with the Owner and Construction Manager and shall move at his own expense any stored products under Contractor's control, including excavated material, which interfere with operations of the Owner or separate contractors.
19. Contractor shall obtain and pay for the use of additional storage of work areas needed for operations.
20. Contractor shall assume full responsibility for the protection and safekeeping of products under this Contract stored on the site and shall cooperate with the Construction Manager to insure security for the Owner's Property.
21. The intention of the work is to follow a logical sequence; however, the Contractor may be required by Construction Manager to temporarily omit or leave out any section of his work, or perform his work out of sequence. All such out of sequence work and come back time to these areas shall be performed at no additional cost.
22. Contractor shall submit a three-week schedule (man-loaded by work activity and area) to Construction Manager each week. Contractor's representative shall attend a weekly meeting with all contractors, chaired by Construction Manager, for the purpose of job coordination and sequencing. Contractor is responsible to coordinate the job with other trades and Construction Manager, and to cooperate with other trades in pursuit of the overall project's shop drawings and actively participate in resolving discrepancies, conflicts, interferences, etc.
23. Each Prime Contractor shall prepare an overall job schedule for his portion of work upon award of Contract, as per section 013216 - Construction Schedules.
24. Sufficient manpower shall be provided at all times to maintain progress of the job. A shortage of labor in the industry shall not be accepted as an excuse for not properly manning the job.
25. The contractor shall take special care in verifying that his equipment matches the characteristics of the power being supplied.
26. Any contractor personnel including project managers, supervisors, etc who engage in any personal attacks, belligerent or threatening speech/texts, etc., to the owner, or any of its agents, will be removed from working on the project.
27. Insubordination, unsafe practices, horseplay, abusive behavior or language, wanton destruction of property, use of drugs or alcohol, possession of firearms, and solicitation shall not be tolerated. There will be no warnings, and Contractor shall designate a responsible on-site supervisor to handle any situations that may arise, including termination.
28. Each contractor is responsible to supply and install all wood blocking/bracing necessary to properly secure their work. This responsibility includes coordinating the installation in concealed areas without delaying other trades.
29. Union business shall not be conducted on site. Any Union representatives that visit the site must declare what Contractor's personnel they represent, and must be escorted by that Contractor's Union steward at all times. No visitors, sales representative or non-working personnel shall be permitted on site without prior consent of the Construction Manager. No photographs shall be taken without the Construction Manager's prior approval.
30. Organize daily clean ups as well as participating in a weekly joint clean up involving all prime contractors onsite. Clean up shall be considered a safety issue. **If any contractor fails to keep the site safe and broom clean within 4 hours of being notified by the**

SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

**Construction Manager, either verbally or in writing, the Construction Manager will have the cleanup work performed by others and will back charge accordingly.**

31. Contractor shall provide protection from damage to adjacent and adjoining work and/or structures. Contractor shall clean, repair and/or replace any damage for which this contractor is responsible.
32. Contractor shall submit hourly rate sheets that would apply to time and material work for all pertinent trades upon Award of Contract.
33. Contractor shall examine surfaces and conditions prior to start of work. Report unacceptable conditions to the Construction Manager. Do not proceed until unacceptable conditions are corrected and acceptable. Starting of work implies acceptance.
34. Upon removal of exterior walls and window units, the building security and weather protection is the responsibility of the prime contractor performing the removals.
35. Each Prime Contractor shall include general housekeeping of light debris. All debris from each Prime Contractor will be collected daily and disposed of into their dumpsters. **In addition to daily general housekeeping, the General Work Contractor (Contract #1) shall provide a weekly broom sweep and damp mop of all areas for the entire duration of the project.** The broom sweep shall include debris from all trades working on site.
36. It is the responsibilities of all Prime Contractors to review the entire summary of work and remaining documents for additional work items.
37. SLEEVES AND SLEEVE LAYOUT - It is the responsibility of the Prime Contractor requiring a sleeve to provide the sleeve and a layout sketch to the Prime Contractor performing the construction activity that the sleeve goes in.
38. Each contractor is responsible to review and become familiar with the scope of work included in all Contracts.
39. Limited site space is available in areas as designated by the Construction Manager. Construction trade parking is not permitted in Owner's employee parking lot.
40. Each contractor shall provide the engineering layout required to properly complete his work from an established working point. Contractor shall employ only competent engineering personnel skilled in performing layout tasks of similar complexity.
41. Prior to commencing the work, each Contractor shall provide written acceptance of grades, structures, substrates, and/or systems installed by other Contractors as suitable for installation of his work. Failure to provide this verification prior to commencing work shall constitute acceptance of the existing conditions.
42. Each Contractor shall coordinate with the Construction Manager for lay down areas, staging areas, and overall use of project site.
43. All contractors and their employees, subcontractors and supplier are expressly prohibited from entering the occupied areas of the school buildings during school hours without prior written permission of the Construction Manager and for using any of its facilities (i.e. restrooms, cafeteria, etc.).
44. Each contractor is responsible for the timely provision of the information required by other Contractors for the progress of other Contractors' work.
45. All contractor foremen must have working cell phone and number provided to CM.
46. No recycled import fill materials are permitted.

SECTION 01 10 00 – SUMMARY OF WORK (MULTIPLE PRIME CONTRACTS)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 011000

## SECTION 01 11 00 – MILESTONE SCHEDULE

### PART 1 - GENERAL

#### 1.1 Milestone

The following milestone schedule serves as a basis for bidding. A Master Schedule will be developed at a general meeting with each of the low bidders within 21 days of Letter of Intent to Award the Contracts. Each prime contractor will coordinate activities, forward submittals, deliver materials and provide necessary manpower to meet the milestones listed below.

#### 1.2 Milestone Schedule

<b>New Maintenance Building</b>	Start	Finish
• Mobilization , Concrete Foundations , U/G Piping, slab	3/28/22	6/03/22
• Metal Building Fabrication / lead time and balance of Maintenance Building Work	9/12/22	11/25/22

Prime Contractors are specifically notified that the project will have down-time due to the current fabrication lead-time associated with the metal building industry. As a result there will be a gap whereby no onsite work is taking place. All contractors should bid and plan accordingly.

The objective of this project is to complete the overall work in the shortest period of time. Thus, if access is provided to a work area sooner than originally scheduled, each contractor will likewise mobilize their forces earlier to maintain the reduction in overall schedule time. Each Contractor is advised that "Time is of the essence" as per Article 13 of the General Conditions and they will work with multiple crews of sufficient size as necessary to carry out the work with the utmost speed with good workmanship. If the contractor fails to expedite and pursue any part of the work, the Owner may order the contractor to take "Extraordinary Measures" as per Article 13, or hire others to complete the work and adjust their contract amount accordingly as per Articles 14 and 17.

Contractors are specifically notified that they must properly man the project with a full time competent field superintendent and a sufficient supply of tradesmen to maintain progress and flow of work as required by schedule and to coordinate/install timely for other trades.

All work required by any of the Owner's representatives and consultants, including the Construction Manager, Architect, Architect's consultants, Owner's Attorneys, etc., to execute final the contract beyond Milestone dates, or to execute final closeout after 30 days past substantial completion, if determined to be caused by contractor, shall result in payment(s) to the Owner for additional services to the Construction Manager, Architect, Architect's consultants, Owner's Attorneys, etc. These costs will then be issued in the form of a deduct change order to the contractor's contract at the Owners consultants' contractual rate.

END OF SECTION



## SECTION 01 21 00 - ALLOWANCES

### 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. Types of allowances include the following:
  - 1. Contingency allowances.
  - 2. Quantity allowances.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section "Modification Procedures" specifies procedures for submitting and handling Change Orders.
  - 2. Division 1 Section "Quality Control Services" specifies procedures governing the use of allowances for inspection and testing.

#### 1.3 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- B. Submit invoices or delivery slips to show the actual quantities of materials delivered to the site for use in fulfillment of each allowance.

#### 1.4 CONTINGENCY & QUANTITY ALLOWANCES

- A. Use the contingency allowance only as directed for the Owner's purposes and only by Allowance Disbursements that indicate amounts to be charged to the allowance.
- B. **The Contractor's overhead and profit, including costs for bonds and insurance, delivery, equipment rental and similar costs, for these allowances shall be included in the values of the general requirements of contract sum and are not chargeable under allowance disbursement.**
- C. At Project closeout, credit unused amounts remaining in the contingency allowance to the Owner by Change Order.

### PART 2 – PRODUCTS (Not Used)

### PART 3 – EXECUTION

#### 3.1 SCHEDULE OF ALLOWANCES

- A. CONTRACT 1 – General Work Contractor:
  - Allowance GC-1: Contractor shall include a contingency allowance of **\$30,000.00** for use according to the Owner's Instructions.
  - Allowance GC-2: Rock Removal : Contractor shall include in their base bid an allowance of 15 cy for removal of rock and replacement with compacted engineered structural fill. (Unit of Measurement: per cubic yard in place)
  - Allowance GC-3: Unsuitable Soil: Contractor shall include in their base bid an allowance of 50 cy for removal of unsuitable soil material and replace with compacted engineered structural fill. (Unit of Measurement: per cubic yard in place)

## SECTION 01 21 00 - ALLOWANCES

- B. CONTRACT 2 – Mechanical Contractor:  
Allowance MC-1: Contractor shall include a contingency allowance of **\$20,000.00** for use according to the Owner's Instructions.
- C. CONTRACT 3 – Electrical Contractor:  
Allowance EC-1: Contractor shall include a contingency allowance of **\$10,000.00** for use according to the Owner's Instructions.
- Allowance EC-2: Rock Removal : Contractor shall include in their base bid an allowance of 10 cy for removal of rock and replacement with compacted engineered structural fill. (Unit of Measurement: per cubic yard in place
- Allowance EC-3: Unsuitable Soil: Contractor shall include in their base bid an allowance of 20 cy for removal of unsuitable soil material and replace with compacted engineered structural fill. (Unit of Measurement: per cubic yard in place
- D. CONTRACT 4 – Plumbing Contractor:  
Allowance PC-1: Contractor shall include a contingency allowance of **\$10,000.00** for use according to the Owner's Instructions.
- Allowance PC-2: Rock Removal : Contractor shall include in their base bid an allowance of 15 cy for removal of rock and replacement with compacted engineered structural fill. (Unit of Measurement: per cubic yard in place
- Allowance PC-3: Unsuitable Soil: Contractor shall include in their base bid an allowance of 20 cy for removal of unsuitable soil material and replace with compacted engineered structural fill. (Unit of Measurement: per cubic yard in place

END OF SECTION 012100



## SECTION 01 22 00 – UNIT PRICES

### PART 1 – GENERAL

#### 1.1 DESCRIPTION

- A. This Section specifies the requirements for measurements and records made for payment purposes and describes the item(s) under which payment(s) will be made for the Work performed under this Contract.
- B. All work shown or specified in the Contract Documents shall be performed.
- C. Items not specified to be measured or paid for (for which no specific pay item exists in the Price Schedule) shall be included in an appropriate unit price item or in a lump-sum item.

#### 1.2 MEASUREMENT REQUIREMENTS

- A. All required measurements shall be made by the Contractor with the Engineer.
- B. Any measurements not witnessed by Engineer and which cannot be verified or substantiated by Engineer will not be approved and payment under the item(s) requiring such measurements will not be made.
- C. Coordinate measurements monthly, for the preparation of periodic pay estimates.
- D. Where payments will be made for removing rock and existing materials, notify Engineer so that he may witness the measurements.
  - 1. All materials removed without conforming to the above procedures, which Engineer cannot verify or substantiate, will not be paid for.
  - 2. Maintain complete, neat, clean, and legible field notes for all measured items.
  - 3. Notes shall contain spaces for Contractor's and Engineer's signatures plus additional space for comments.
  - 4. An original and a carbon copy shall be made for all notes and one copy shall be turned over to Engineer daily.
  - 5. The Engineer's signature shall not be constituted as an acceptance of the work, or the measurements made, but shall mean that he was present when the measurements were made.

#### 1.3 SUBMITTALS

- A. See Section 013300.
- B. See Section 012300.
- C. Field notes of all measurements for payment purposes delivered to Engineer daily.
- D. Copies of all invoices required for payments out of cash allowance(s).
- E. Monthly Applications for Payment.
- F. Record Drawings showing the locations and quantities of all items measured for payment purposes.

## SECTION 01 22 00 – UNIT PRICES

### 1.4 SCHEDULING

- A. Notify Engineer, as far in advance as possible, of the recording of measurements so that Engineer may observe existing conditions, work being performed, and measurements being made.
- B. Allow for and afford Engineer ample time, space, and equipment to observe measurements and to verify measurements and elevations.

### PART 2 – PRODUCTS

#### 2.1 GENERAL

- A. Provide all labor, materials, facilities, levels, measuring devices and all other equipment and items necessary to properly and accurately perform all measurements for payment purposes.
- B. Payment for certain items not specifically listed in the bid forms but otherwise required by the technical specifications shall be deemed included as part of the General Conditions and the individual unit price and lump sum bid items provided for in the proposal.

### PART 3 – EXECUTION

#### 3.1 GENERAL

- A. Perform all measuring required under this Section.
- B. Record all measurements and calculated quantities on the Record Drawings.
- C. No measurement shall be made for work performed within the limits of Lump Sum Items.

#### 3.2 UNIT PRICE SCHEDULE

##### **General Contractor**

##### Unit Price GC No. 1: Rock Removal

- a) Description : Provide all labor, materials and equipment to remove rock and replace with compacted structural fill, to be used as an add or deduct from base bid quantities and/or allocation of bid allowance.
- b) Unit of Measurement: per cubic yard of trench rock measured in place

##### Unit Price GC No. 2: Replacement of Unsuitable Backfill Material

- a) Description (Unit price cost): Removal of unsuitable material under unclassified excavation and disposal and Installation of suitable backfill material placed and compacted to replace unsuitable material to be used as an add or deduct from base bid quantities and/or allocation of bid allowance.
- b) Unit of Measurement: per cubic yard in place

##### **Mechanical Contractor**

**NONE**

## SECTION 01 22 00 – UNIT PRICES

### **Electrical Contractor**

#### Unit Price EC No. 1: Trench Rock

- a) Description : Provide all labor, materials and equipment to remove trench rock and replace with compacted structural fill, to be used as an add or deduct from base bid quantities and/or allocation of bid allowance.
- b) Unit of Measurement: per cubic yard of trench rock measured in place

#### Unit Price EC No. 2: Replacement of Unsuitable Backfill Material

- a) Description (Unit price cost): Removal of unsuitable material under unclassified excavation and disposal and Installation of suitable backfill material placed and compacted to replace unsuitable material to be used as an add or deduct from base bid quantities and/or allocation of bid allowance.
- b) Unit of Measurement: per cubic yard in place

### **Plumbing Contractor**

#### Unit Price PC No. 1: Trench Rock

- a) Description : Provide all labor, materials and equipment to remove trench rock and replace with compacted structural fill, to be used as an add or deduct from base bid quantities and/or allocation of bid allowance.
- b) Unit of Measurement: per cubic yard of trench rock measured in place

#### Unit Price PC No. 2: Replacement of Unsuitable Backfill Material

- a) Description (Unit price cost): Removal of unsuitable material under unclassified excavation and disposal and Installation of suitable backfill material placed and compacted to replace unsuitable material to be used as an add or deduct from base bid quantities and/or allocation of bid allowance.
- b) Unit of Measurement: per cubic yard in place

END OF SECTION 012200



## SECTION 012300 – ALTERNATES

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

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

#### 1.03 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.

#### 1.04 PROCEDURES

- A. Make certain the Bid Form clearly states that costs listed for each alternate include costs of related coordination, modification, or adjustment.
- B. 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.
- 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.
- E. The general, mechanical, electrical, and plumbing contractors shall provide all labor and materials for the interior fit out of the new pre-engineered maintenance building as outlined in the schedule of alternates.
- F. The Base Bid shall include all civil, structural, and pre-engineered building scope of work, as well as all scope of work depicted on the contract drawings associated with the existing middle school building. The Base Bid shall also include all labor and materials required for all under slab plumbing and electrical elements. Base Bid shall include providing wiring from electrical panel(s) to concrete slab penetration plus twenty (20) feet.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 SCHEDULE OF ALTERNATES

- A. **Add Alternate No. 1-1:** The general contractor (GC) shall furnish and install all labor and materials for Rooms 01 – 06
- Interior walls
  - Interior doors
  - Interior door frames
  - Interior door hardware
  - finished ceilings
  - interior finishes
  - all casework and millwork
  - Coordination with all prime contractors for all work depicted in the construction documents.
  - All other work will be base bid
- B. **Add Alternate No. 2-1:** The mechanical contractor (MC) shall furnish and install all labor and materials for:
- ACCU-1 / AC-1 and associated elements
  - Heating and cooling equipment and all associated ductwork, hangers, and components associated with temperature control for the administrative and storage areas Rooms 01 – 06
  - Exhaust fan and associated components for the Toilet & Changing Room
  - All HVAC equipment for the Maintenance Shop 07 shall be included in the base bid.
- C. **Add Alternate #3-1:** The electrical contractor (EC) shall furnish and install all labor and materials for the following interior electrical elements located within the interior fit out area (Vestibule 01, Break 02, Closet 03, Toilet & Changing 04, Closet 05, and Paper Storage 06):
- light fixtures, switches, and wiring
  - electrical outlets
  - exhaust fan in the toilet room
  - power supply to all heating and cooling equipment (and all associated components)
  - power supply to all plumbing fixture components that require electrical power that are in walls/ceilings in the Vestibule, Break Room, Closet. Toilet/Changing Room, and Paper Storage. Rooms 01 – 06.
  - All electrical elements depicted on the construction drawings in the existing building are part of the Base Bid.
  - All electrical elements depicted on the construction drawings in the Maintenance Shop 07 area are part of the Base Bid.
  - All electrical elements depicted on the construction drawings on the project site are part of the Base Bid.
  - All electrical elements depicted on the construction drawings under slab are part of the Base Bid.

- D. **Add Alternate #4-1:** The plumbing contractor (PC) shall furnish and install all labor and materials for:
- All plumbing fixtures and associated piping in the Break Room 02, Toilet & Changing Room 04, and the Closet 05. (Hose bib and associated piping included in base bid). Note that all buried or concealed infrastructure required for the interior fit out as part of Add Alternate #1 must be installed by the PC as part of base bid.
  - Backflow Preventor and Domestic Hot Water Heater and associated appurtenances are Base Bid.

END OF SECTION 012300





## SECTION 012500 – SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements: Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.
  - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

#### 1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
  - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

#### 1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use CSI Form 13.1A
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication, or installation cannot be provided, if applicable.
    - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

- e. Samples, where applicable or requested.
  - f. Certificates and qualification data, where applicable or requested.
  - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
  - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES
  - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
  - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 10 days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

## 1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

## 1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than **15** days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
  - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - b. Substitution request is fully documented and properly submitted.
  - c. Requested substitution will not adversely affect Contractor's construction schedule.
  - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - e. Requested substitution is compatible with other portions of the Work.
  - f. Requested substitution has been coordinated with other portions of the Work.
  - g. Requested substitution provides specified warranty.
  - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed unless otherwise indicated.
- C. Substitutions for Convenience: Architect will consider requests for substitution if received within 30 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
  - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  - b. Requested substitution does not require extensive revisions to the Contract Documents.
  - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - d. Substitution request is fully documented and properly submitted.
  - e. Requested substitution will not adversely affect Contractor's construction schedule.
  - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - g. Requested substitution is compatible with other portions of the Work.
  - h. Requested substitution has been coordinated with other portions of the Work.
  - i. Requested substitution provides specified warranty.
  - j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

### PART 3 - EXECUTION (Not Used)

END OF SECTION 012500



## SECTION 01 26 00 – CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### I.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.

#### I.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing contract modifications.
  - 1. Provisions of this Section apply to the work of each prime contractor.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section "Submittals" for requirements for the Contractor's Construction Schedule.
  - 2. Division 1 Section "Applications for Payment" for administrative procedures governing Applications for Payment.
  - 3. Division 1 Section "Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

#### I.3 MINOR CHANGES IN THE WORK

- A. The Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or Contract Time, on AIA Form G710, Architect's Supplemental Instructions.

#### I.4 CHANGE ORDER PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: The Architect will issue a detailed description of proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Proposal requests issued by the Architect are for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.
  - 2. Within 10 days of receipt of a proposal request, submit an estimate of cost necessary to execute the change to the Architect for the Owner's review.
    - a. Include a **fully itemized** list of quantities of products required and unit costs, with the total amount of purchases to be made. Furnish survey data and backup invoices, quotes paperwork to substantiate.
    - b. Separate labor hours by trade and indicate labor rate. (Submit attached labor rate worksheet notarized for each trade / classification.)
    - c. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - d. Include an updated Contractors Construction Schedule that indicates the effect of the change, including but not limited to; changes in activity duration, start and finish times, and activity relationship. Use available float before requesting an extension of contract time.

## SECTION 01 26 00 – CONTRACT MODIFICATION PROCEDURES

- B. Contractor-Initiated Proposals: When latent or unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
  2. Include a **fully itemized** list of quantities of products required and unit costs, with the total amount of purchases to be made. Furnish survey data to substantiate quantities. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  3. Separate labor hours by trade and indicate labor rate. (Submit attached labor rate worksheet notarized for each trade / classification.)
  4. Comply with requirements in Section "Product Substitutions" if the proposed change requires substitution of one product or system for a product or system specified.
  5.
    - a. Include an updated Contractors Construction Schedule that indicates the effect of the change, including but not limited to; changes in activity duration, start and finish times, and activity relationship. Use available float before requesting an extension of contract time.
- C. Proposal Request Form: Use AIA Document G709 for Change Order Proposal Requests.

### I.5 ALLOWANCES

- A. Allowance Adjustment: For allowance-cost adjustment, base each Change Order Proposal on the difference between the actual purchase amount and the allowance, multiplied by the final measurement of work-in-place. Where applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
1. Include installation costs in the purchase amount only where indicated as part of the allowance.
  2. When requested, prepare explanations and documentation to substantiate the margins claimed.
  3. Submit substantiation of a change in scope of work claimed in the Change Orders related to unit-cost allowances.
  4. The Owner reserves the right to establish the actual quantity of work-in-place by independent quantity survey, measure, or count.
  5. **Contractor's overhead and profit, including costs for bonds & insurances, for these allowances shall be included in the values of the general requirements of contract sum and are not chargeable under allowance disbursement.**
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or the Contractor's handling, labor, installation, overhead, and profit. Submit claims within 15 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. The Owner will reject claims submitted later than 15 days.
1. Do not include the Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in Contract Documents.
  2. No change to the Contractor's indirect expense is permitted for selection of higher or lower-priced materials or systems of the same scope and nature as originally indicated.

## SECTION 01 26 00 – CONTRACT MODIFICATION PROCEDURES

### I.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When the Owner and the Contractor disagree on the terms of a Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714/CMA. The Construction Change Directive instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  - 1. The Construction Change Directive contains a complete description of the change in the Work. It also designates the method to be followed to determine change in the Contract Sum or Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  - 1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

### I.7 CHANGE ORDER PROCEDURES

- A. Upon the Owner's approval of a Proposal Request, the Architect or Construction Manager will issue a Change Order for signatures of the Owner, Architect, Construction Manager and the Contractor on AIA Form G701.
- B. Contractor cannot requisition for any allowance or change order work until the paperwork has been fully executed by the Contractor, CM, Architect and Owner.
- C. Requests for changes in bond fees, if any, will be analyzed at the conclusion of the project. Contractors bonding company to submit substantiation. (Bond amount based on total adjusted contract value)

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 012600

SECTION 01 26 00 – CONTRACT MODIFICATION PROCEDURES



**Arris Contracting Company, Inc.**  
**189 Smith Street**  
**Poughkeepsie, NY 12601**

**LABOR RATE WORKSHEET**

Project No. \_\_\_\_\_

Contractor Name: _____		County: _____		Date: _____	
Address: _____					
Telephone Number: _____					
Trade: _____ (Provide separate sheet for each trade, foreman/journeyman, etc.)				REGULAR BASE RATE	PREMIUM TIME BASE RATE
<b>A. WAGE RATE PER HOUR</b>					
BENEFITS (* Identifies benefits paid directly to the Employee.)	*	% per hour	\$ per hour		
Vacation and Holiday					
Health and Welfare					
Pension					
Annuity					
Education / Apprentice Training					
Supplemental Unemployment					
Security Fund					
Industry Advancement					
UBC-Appr., Health, Safety, Educ.					
Labor Management Fund					
<b>B. TOTAL BENEFITS PER HOUR</b>					
<b>PAYROLL TAXES AND INSURANCE</b>					
F.I.C.A. / Social Security (up to the maximum required by law)			%		
Medicare			%		
Federal Unemployment (up to a maximum of \$56.00 per employee per year)			%		
State Unemployment (up to 1st \$8,500 of base salary paid per employee per year)			%		
Workers' Compensation Code: _____			%		
Disability			%		
<b>C. TOTAL TAXES AND INSURANCE PER HOUR</b>					
All Benefits are paid directly to Employee.			_____ x _____	% =	
Only benefits identified by * are paid directly to Employee.					
<b>D. TOTAL LABOR RATE</b>				<b>(A + B + C) =</b>	
<b>E. DOCUMENTATION</b>					
For General Liability and Workers Compensation, provide policy renewal page from insurance carrier (with contractor name, address, and insurance agent) for substantiation purposes.					
<b>F. CONTRACTOR'S CERTIFICATION</b>					
I certify that the labor rates, insurance enumerations, labor fringe enumerations and expenses are correct and in accordance with actual and true cost incurred.					
Signature _____			Sworn before me this _____ day		
Print Name of Authorized Representative _____			of _____, 20 _____.		
Print Title _____			Notary Public _____		



## SECTION 01 29 00 – PAYMENT 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 specifies administrative and procedural requirements governing each prime contractor's Applications for Payment.
  - 1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, Submittal Schedule, and List of Subcontracts.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
  - 1. Schedules: The Contractor's Construction Schedule and Submittal Schedule are specified in Division 1 Section "Submittals."

#### 1.3 SCHEDULE OF VALUES

- A. Coordination: Contractor shall coordinate preparation of its Schedule of Values for the Work with preparation of the Contractors' Construction Schedule.
  - 1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
    - a. Contractor's Construction Schedule.
    - b. Application for Payment forms, including Continuation Sheets.
    - c. List of subcontractors.
    - d. Schedule of allowances.
    - e. Schedule of alternates.
    - f. Schedule of submittals.
  - 2. Submit the Schedule of Values to the Construction Manager within 10 days of receipt of Letter of Intent but no later than 10 days before the date scheduled for submittal of the initial Applications for Payment. (SOV's received after the 15<sup>th</sup> of the month, will not be allowed to requisition until the following month, due to input time for CM & owner into their computer systems.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish the format for the Schedule of Values. Provide at least one line item for each Specification Section.
  - 1. Identification: Include the following Project identification on the Schedule of Values:
    - a. Project name and location. (Each school and additions / renovations, will require separate breakdown sections, front end, etc. with subtotals)
    - b. Name of the Architect.
    - c. Project number.
    - d. Contractor's name and address.
    - e. Date of submittal.
  - 2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
    - a. Related Specification Section or Division.
    - b. Description of Work.
    - c. Name of subcontractor.
    - d. Name of manufacturer or fabricator.
    - e. Name of supplier.

## SECTION 01 29 00 – PAYMENT PROCEDURES

- f. Change Orders (numbers) that affect value.
  - g. Dollar value.
    - 1) Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
- 3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Break principal subcontract amounts down into several line items where requested by Construction Manager. Multiple line items will be provided for amounts in excess of five percent of the contract sum, broken out into sub components equaling not greater than five percent each. Separate all line items by material & labor.
  - a. Breakdown shall be separated between additions and renovations with subtotals for each.
- 4. In addition to the breakdown of specification sections, separate line items will be required for the following front-end line items:
  - a. Bonds & OCP insurances to have separate line items. (substantiation letters required from bonding & insurance company for any amounts higher than industry standard). Only OCP insurance allowed for insurance line item. All other insurance costs must be distributed by contractor throughout the various sections.
  - b. Supervision – include a minimum of one percent of contract sum.
  - c. Project Administration – include a minimum of one percent of contract sum
  - d. Project meetings (appropriate value for weekly attendance for entire duration of project – see Section 01 31 19 Project Meetings for amount)
  - e. Punchlist – include a minimum of .5 percent of contract sum
  - f. Closeout: separate lines for demobilization, Operation & maintenance manuals, Closeout paperwork, Demonstration & training (total for closeout minimum two percent of contract value)
  - g. Continuous Clean-up and Final Clean-up values each at minimum of .5 %
  - h. General Contractor to add line item for Broom sweep/ damp mopping
- 5. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.
- 6. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.
  - a. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing.
- 7. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- 8. Unit-Cost Allowances: Show the line-item value of unit-cost allowances, as a product of the unit cost, multiplied by the measured quantity. Estimate quantities from the best indication in the Contract Documents.
- 9. Margins of Cost: Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.
  - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at the Contractor's option.
- 10. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

## SECTION 01 29 00 – PAYMENT PROCEDURES

### 1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
  - 1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.
- B. Payment-Application Times: Each progress-payment date is indicated in the Agreement. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment-Application Times: The date for each progress payment is the 21st day of each month (or as designated by the Owner). The period covered by each Application for Payment is the previous month.
- D. Payment-Application Forms: Use AIA Document G732/CMA (include line for Construction Manager signature) and Continuation Sheets G703 as the form for Applications for Payment.
  - 1. Separate Continuation Sheets shall be provided for work which takes place on each building, which will detail that portion of the contract which is attributable to the specific building. The appropriate S.E.D. project number(s) shall be shown on the top of each continuation form.
- E. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Construction Manager will return incomplete applications without action.
  - 1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
  - 2. Include amounts of Change Orders and Allowances issued prior to the last day of the construction period covered by the application. (No Change order or Allowance requisitions can be made or listed on the requisition, unless the formal CO/AD paperwork has been fully executed by Contractor, Construction Manager, Architect and owner)
  - 3. Provide digital copies of payrolls which are signed and notarized documenting compliance with prevailing wage laws. Payroll for contractors is required from the 25<sup>th</sup> of the previous month to the 24<sup>th</sup> of the current month. Payroll for subcontractors is required from the 15<sup>th</sup> of the previous month to the 14<sup>th</sup> of the current month.
  - 4. Provide copies of lien waivers for the previous payment. (or anticipated payment) Include certificate of monthly payment for subcontractors for the previous month.
  - 5. Provide OSHA 10 certificates for all workers on site.
  - 6. Payment for stored materials (whether onsite but not installed, or offsite in a secured warehouse) will require a bill of lading showing the exact value and photographs. In no case shall more than 90% be approved for uninstalled stored materials. An Insurance certificate must be provided, specific to the materials stored with the appropriate dollar value. (for onsite or offsite materials).
- F. Transmittal: Submit 1 digital signed and notarized copy ( Blue ink ) of each Application for Payment to the Construction Manager by a method ensuring receipt within 24 hours. Each requisition shall be complete, and securely attached to include all waivers of lien, certified payrolls and similar attachments.
  - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Architect and Construction Manager.

## SECTION 01 29 00 – PAYMENT PROCEDURES

- G. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics liens from subcontractors, sub-subcontractors and suppliers for the construction period covered by the previous application.
1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
  2. When an application shows completion of an item, submit final or full waivers.
  3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
    - a. Submit final Applications for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
  4. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to the Owner.
- H. Initial Application for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment include the following. The initial payment application will not be processed until all of these actions and submittals have been received by the Construction Manager. When preliminary submissions are received with the initial application (items 4 and 7), the final submission for these items must be received and approved by the Construction Manager prior to submission of the second application for payment.
1. List of subcontractors.
  2. List of principal suppliers and fabricators.
  3. Schedule of Values.
  4. Contractor's Construction Schedule (preliminary if not final).
  5. Schedule of principal products.
  6. Schedule of unit prices.
  7. Submittal Schedule (preliminary if not final).
  8. List of Contractor's staff assignments.
  9. List of Contractor's principal consultants.
  10. Copies of building permits.
  11. Copies of authorizations and licenses from governing authorities for performance of the Work.
  12. Initial progress report.
  13. Report of preconstruction meeting.
  14. Certificates of insurance and insurance policies.
  15. Performance and payment bonds.
  16. Data needed to acquire the Owner's insurance.
  17. Initial settlement survey and damage report, if required.
- I. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.
1. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
  2. Administrative actions and submittals that shall precede or coincide with this application include:
    - a. Occupancy permits and similar approvals.
    - b. Warranties (guarantees) and maintenance agreements.
    - c. Test/adjust/balance records.
    - d. Maintenance instructions.
    - e. Meter readings.
    - f. Startup performance reports.
    - g. Changeover information related to Owner's occupancy, use, operation, and maintenance.

## SECTION 01 29 00 – PAYMENT PROCEDURES

- h. Final cleaning.
  - i. Application for reduction of retainage and consent of surety.
  - j. Advice on shifting insurance coverages.
  - k. Final progress photographs.
  - l. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.
- J. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:
- 1. Completion of Project closeout requirements.
  - 2. Completion of items specified for completion after Substantial Completion.
  - 3. Ensure that unsettled claims will be settled.
  - 4. Ensure that incomplete Work is not accepted and will be completed without undue delay.
  - 5. Transmittal of required Project construction records to the Owner.
  - 6. Certified property survey.
  - 7. Proof that taxes, fees, and similar obligations were paid.
  - 8. Removal of temporary facilities and services.
  - 9. Removal of surplus materials, rubbish, and similar elements.
  - 10. Change of door locks to Owner's access.

### PART 2 - PART 1 - PRODUCTS (Not Applicable)

### PART 3 - EXECUTION

- 3.1 No retainage release will be approved by owner until all closeout documents (Closeout paperwork, as-builts, O & M manuals, AIA release forms, warranties, material turnover receipts, etc.) are received and verified complete.

END OF SECTION 012900



## SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 – GENERAL

#### I.0 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.

#### I.1 SUMMARY

- A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:
- General project coordination procedures.
  - Conservation.
  - Coordination Drawings.
  - Administrative and supervisory personnel.
  - Cleaning and protection.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
- Division 1 Section "Project Meetings" for progress meetings, coordination meetings, and pre-installation conferences.
  - Division 1 Section "Construction Progress Schedule" for preparing and submitting the Contractor's Construction Schedule.
  - Division 1 Section "Materials and Equipment" for coordinating general installation.
  - Division 1 Section "Execution and Closeout Requirements" for coordinating contract closeout.

#### I.2 COORDINATION

- A. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.
- Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
  - Make provisions to accommodate items scheduled for later installation.
  - Contractor is required to coordinate with their subcontractors, other Prime contractors and the Construction Manager, ahead of the work progressing.
- B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
- Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.

- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
- Preparation of schedules.
  - Installation and removal of temporary facilities.
  - Processing of submittals and photocopying/delivery to affected contractors.
  - Progress meetings.
  - Project closeout activities.
- D. Conservation: Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.
- Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work.

### I.3 SUBMITTALS

- A. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components. (e.g. – subslab piping, ceiling spaces, etc.)
- Show the relationship of components shown on separate Shop Drawings.
  - Indicate required installation sequences.
  - Comply with requirements contained in Section "Submittals."
  - HVAC Contractor will begin coordination drawing process within 15 calendar days of award of Contract by providing ¼" scale drawings indicating locations of all ductwork layout, piping layout, Bottom of duct etc. Electronic copies will then be forwarded to the Plumbing Contractor for their piping input, then submitted to Electrical Contractor for lighting fixtures, main feeders and clearances. Finally, to the General Contractor for ceiling information (Each contractor shall complete their review and mark-ups within 5 days)
  - A coordination meeting with all Contractors and subcontractors to review completed coordination drawings will be held within 45 days of Contract award.
- B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. Electronic CAD Files of Project Base Plan Drawings: May only be used to expedite production of Shop Drawings for the Project. Use for other Projects or purposes is not allowed.
  2. Electronic CAD files of Project Drawings: Distributed only under the following conditions:
    - a. Use of files is solely at receiver's risk. Architect/Engineer does not warrant accuracy of files. Receiving files in electronic form does not relieve receiver of responsibilities for measurements, dimensions, and quantities set forth in Contract Documents. In the event of ambiguity, discrepancy, or conflict between information on electronic media and that in Contract Documents, notify Architect/Engineer of discrepancy and use information in hard-copy Contract Drawings and Specifications.
- CAD Files do not necessarily represent the latest Contract Documents, existing conditions, and as-built conditions. Receiver is responsible for determining and complying with these conditions and for incorporating addenda and modifications.
- b. User is responsible for removing information not normally provided on Shop Drawings and removing references to Contract Documents. Shop Drawings



submitted with information associated with other trades or with references to Contract Documents will not be reviewed and will be immediately returned.

- c. Receiver shall not hold Architect/Engineer responsible for data or file clean-up required to make files usable, nor for error or malfunction in translation, interpretation, or use of this electronic information.
- d. Receiver shall understand that even though Architect/Engineer has computer virus scanning software to detect presence of computer viruses, there is no guarantee that computer viruses are not present in files or in electronic media.
  - 1) Receiver shall not hold Architect/Engineer responsible for such viruses or their consequences, and shall hold Architect/Engineer harmless against costs, losses, or damage caused by presence of computer virus in files or media.
- 3. Upon request to the Architect, and at the Architect's sole discretion, Base Plan Drawings only may be provided to the Prime Contractor in electronic format (for example, AutoCAD format) by the Architect at a charge rate to cover the architect's cost for producing.
- 4. Prior to the Architect's dispensing of documents in electronic format, the Contractor shall execute and deliver an "Electronic Media Release Agreement," provided upon request by Architect, along with said payment.

- C. Staff Names: Within 15 days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
  - Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.0 GENERAL COORDINATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

### 3.1 CLEANING AND PROTECTION

- A. Prime Contractor is to clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.
- B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.
- C. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
  - 1. Excessive static or dynamic loading.

2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining, and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. High-speed operation.
20. Improper lubrication.
21. Unusual wear or other misuse.
22. Contact between incompatible materials.
23. Destructive testing.
24. Misalignment.
25. Excessive weathering.
26. Unprotected storage.
27. Improper shipping or handling.
28. Theft or vandalism

### 3.3 REQUESTS FOR INTERPRETATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI and forward to the Construction Manager via the internet web-based service.
- B. RFI's shall originate with Contractor. RFI's submitted by entities other than Contractor will be returned with no response.
  1. Coordinate and submit RFI's in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- C. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
  1. Project Name.
  2. Date.
  3. Name of Contractor.
  4. Name of Architect and Construction Manager.
  5. RFI number, numbered sequentially. Use prefix based on Contract (i.e. MC, EC).
  6. Specification Section number and title and related paragraphs, as appropriate.
  7. Drawing number and detail references, as appropriate.
  8. Field dimensions and conditions, as appropriate.
  9. Contractor's suggested solution(s). If Contractor solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  10. Contractors Signature.

11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings and other information necessary to fully describe items needing interpretation.
  - a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies and attachments.
- D. Architect's Action: Architect will review each RFI, determine action required, and return it.
  1. The following RFIs will be returned without action:
    - a. Requests for approval of substitutions.
    - b. Requests for coordination information already indicated in the Contract Documents.
    - c. Requests for adjustments in the Contract Time or the Contract Sum.
    - d. Requests for interpretation of Architect's actions on submittals.
    - e. Incomplete RFIs or RFIs with numerous errors.
  2. Architect's action may include a request for additional information.
  3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 10 days of receipt of the RFI response.
- E. On receipt of Architect's and Construction Manager's action, immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within seven days if Contractor disagrees with response.

### 3.4 DEFICIENCY REPORTS

- F. If the owner, Architect, or Construction Manager notes a deficiency in an installation, material, etc. they will issue a deficiency report via the internet web-based service to the appropriate contractor. The contractor has 2 weeks to correct the deficiency and upon completion must respond back in Primavera. The A/E will then perform a follow-up inspection to confirm that the deficiency was adequately corrected.

### 3.5 Department of Labor Overtime Request

- A. The DOL overtime request form shall be filled out and forwarded by each contractor to the Construction manager prior to the start of any onsite work. ( See Div 0 for form) Contractors will not be allowed to work Weekends or after hours unless the DOL has been properly notified.

END OF SECTION 013100



The contents of this Section are **NOT** authored by the Owner, Architect of Record, Engineers of Record, nor the Construction Manager, but are provided as guidelines published by others, including but not limited to, the CDC, ESD (Empire State Development), DOH, OSHA, etc.

- 1.1 In response to the public health emergency for the COVID-19, Governor Andrew Cuomo has declared a State disaster emergency and temporarily suspended or modified laws that would prevent, hinder, or delay action necessary to cope with the disaster or emergency. The Governor has also issued directives to allow for the expansion of certain services including those relating to emergency procurement, and to facilitate the continued work of essential businesses. Under Executive Order 202.6, as amended September 2020, a construction project is permitted to continue if it is essential. Please refer to Empire State Development (ESD) guidance to determine if your project is essential <https://esd.ny.gov/guidance-executive-order-2026>. The purpose of this guidance is to set forth the recommended practices for all Contractors performing work at construction sites in the context of the COVID-19 health crisis.

A. Contractor Responsibilities:

Under standard contracting agency/authority agreements,

1. Contractors and their subcontractors are always required to guard the safety and health of all persons on and in the vicinity of the work site
  2. Contractors and their subcontractors are required to comply with all applicable rules, regulations, codes, and bulletins of the New York State Department of Labor and the standards imposed under the Federal Occupational Safety and Health Act of 1970, as amended ("OSHA")
  3. Contractors and their subcontractors are also required to comply with all Client safety requirements. **The Mt Pleasant Central School District maintains strict COVID protocols. Each Monday morning at 7:00 am , all prime contractors are required to provide a listing of all construction personnel employed for their contract, whether employed by the prime contractor or subcontractor, who will be onsite that week and their status of vaccinated or non – vaccinated. The listing is to include, 1) The company the worker is employed by, 2) copy of proof of vaccination or 3) a weekly negative test result taken within 72 hours.**
  4. Contractors and their subcontractors must comply with all City or State of New York safety requirements for projects within the City or State of New York constructed in accordance with the applicable building code, and contractors are required to provide written safety plans for the site showing how all safety requirements of applicable law will be implemented for the duration of the contract
  5. Contractors will comply with these requirements as part of their contract, as well as any updates / revisions which are subsequently issued by the governing agencies.
- 1.2 Contractors and their subcontractors must also adhere to the following practices to help prevent exposure and spread of COVID-19. The following recommendations are based on what is currently known about COVID-19. Contractors and their subcontractors are advised to stay current and immediately implement the most up-to-date practices to protect the safety and health of your employees, clients, and the general public.

## SECTION 01 31 50 – COVID-19 CONTRACTOR COMPLIANCE

### A. Contractor Submittals

1. All contractors are required to submit a copy of their own company policy which confirms their compliance with these requirements and demonstrates your workers will properly comply.
2. Designate a specific “Responsible party” who will be the individual on-site in charge of COVID compliance
3. Include in your submission the name of the designated individual who will be onsite.

### B. General Responsibilities:

1. Contractors and their subcontractors should educate their employees on the symptoms of COVID-19, which include cough, fever, trouble breathing, and pneumonia. Contractors and their subcontractors must instruct any employee who feels they may meet the above criteria to refrain from reporting to the jobsite and immediately contact their local health department in the county in which they reside.
2. If the employee begins to exhibit these symptoms while in the workplace, steps should be taken to isolate the individual, place a surgical mask on the individual and inform your local health department and the contracting agency/authority.
3. Personnel should be advised to self-quarantine in accordance with the requirements of the New York State and local health department. Contracting agencies/authorities reserve the right to require any employee of the Contractor, and their subcontractors exhibiting symptoms, to be removed from the jobsite.
4. If an employee is confirmed to have COVID-19 infection, contractors and their subcontractors should inform fellow employees, who have been in contact with this employee, of their possible exposure to COVID-19 in the workplace while maintaining confidentiality as required by applicable New York State and federal law. The fellow employees should then self-monitor for symptoms (i.e., cough, fever, trouble breathing, and pneumonia) and self-quarantine in accordance with the requirements of the New York State and local health department.
5. If an employee tests positive for COVID-19, Contractors and their subcontractors should direct the employee to self-quarantine or remain quarantined for 14 days, following the guidance of New York State and local health department.
6. Contractors and their subcontractors may permit such employee to return to the jobsite when this employee produces a negative COVID-19 test or receives medical clearance to return to work.
7. If an employee tests negative for COVID-19, contractors and their subcontractors may direct the employee to return to work after recovery from their illness. Any direct contacts on pre-cautionary quarantine may return to the jobsite and resume their work activities.

### C. Social Distancing:

1. Do not host large group meetings or congregate in large groups. When meetings are necessary, maintain a distance of 6 feet between people
2. Perform any toolbox or other training maintaining the distance of 6 feet between people
3. Perform meetings online or via conference call whenever possible
4. Only essential personnel should be permitted on the jobsite
5. Discourage handshaking and other contact greetings

### D. General Jobsite Practices:

1. Procedures and supplies should be in place to encourage proper hand and respiratory hygiene. **(General Work Contractor is required to provide, install and maintain self -**

**contained temporary hygiene/washing station(s) for use by all workers – provide minimum 1 washing station per 20 workers)**

a. Hand Hygiene:

Signage with handwashing procedures should be posted in prominent locations promoting hand hygiene:

1. Regular handwashing with soap and water for at least 20 seconds should be done:
  - Before and after eating.
  - After sneezing, coughing, or nose blowing
  - After using the restroom
  - Before handling food
  - After touching or cleaning surfaces that may be contaminated
  - After using shared equipment and supplies; and also
  - Whenever a contractor or subcontractor believes it is necessary
2. If soap and water are not available, use an alcohol-based hand sanitizer that contains at least 60% alcohol

b. Respiratory Hygiene:

1. **ALL SITE PERSONELL MUST WEAR FACE COVERING PROTECTION AT ALL TIMES TO COVER MOUTH AND NOSE (No Exceptions)**
2. Covering coughs and sneezes with tissues or the corner of elbow
3. Disposing of soiled tissues immediately after use
2. **At the end of each work shift each Contractor will perform routine environmental cleaning and disinfecting of all hard surfaces in the common and work areas.** This includes corridor surfaces, doorknobs, workstations, project trailers and offices, portable toilets, countertops, handles, gang boxes, tools and equipment. See OSHA Guidance on Preparing Workplaces for COVID-19. [www.osha.gov/Publications/OSHA3990.pdf](http://www.osha.gov/Publications/OSHA3990.pdf)
3. Appropriate cleaning agents and directions should be utilized to perform all cleaning. Ensure all workers are trained on the hazards of cleaning chemicals used in the workplace and comply with all OSHA requirements regarding same in accordance with the Hazard Communication (Global Harmonization) Standard. Information about <https://coronavirus.health.ny.gov/home>
4. Do not use a common water bottle
5. If using a common water cooler clean dispenser knob after use
6. Do not share tools
7. Utilize personal protection equipment (PPE) for the job being performed
8. Sanitize reusable PPE per manufacturer's recommendation prior to each use
9. Do not share PPE
10. Ensure used PPE and other trash is disposed of properly
11. Utilize disposable gloves where appropriate and instruct workers to wash hands after removing gloves
12. Disinfect reusable supplies and equipment
13. Stagger work schedules to minimize the number of people on a job site at any one time
14. Keep one contractor or subcontractor in an area at a time. Indicate an area is occupied with workers with a sign or flag indicating which contractor or subcontractor is in the area at that time. Remove the sign or flag after completion of work in that area to let others know they may then enter into that area to perform their work. The next contractor or subcontractor will then post their sign or flag to notify others that the area is occupied.

## SECTION 01 31 50 – COVID-19 CONTRACTOR COMPLIANCE

15. Minimize the number of workers in an area as much as possible by using indicators of an occupied area (signs or flags) scheduling work activities to stagger those required to be in any one time to a minimal number of workers.
  16. Minimize entryways into a work area so that employees will be able to observe flagging practices described above. Do not reduce number of emergency exits.
  17. Avoid cleaning techniques, such as pressurized air or water sprays that may result in generation of bioaerosols
- 1.3 Contracting agencies/authorities may request an updated written safety plan for the site to address practices to help prevent exposure and spread of COVID-19 at the jobsite pursuant to New York State, OSHA recommendations and Centers for Disease Control requirements, which include:
1. Assessment of potential worker exposure hazards, taking into account the specific recommendations and controls for the four levels of worker exposure risk identified in OSHA's Guidance on Preparing Workplaces for COVID-19 (i.e. very high, high, med, Low)
  2. Selecting, implementing, and ensuring the use of control (i.e., social distancing appropriate personal protective equipment, hygiene, and cleaning supplies);
  3. Minimizing the number of workers in an area as much as possible by using indicators of an occupied area (signs or flags) and scheduling work activities to stagger those required to be in any one area to a minimal number of workers.
  4. Minimize entryways into a work area so that employees will be able to observe flagging practices described above. Do not reduce number of emergency exits; and
  5. Additional criteria consistent with health and safety practices at the work site
- 1.4 Project Closure:
1. Where work is suspended on a project, contractors are directed to follow any additional project shut-down protocols as provided by the contracting agency/authority
  2. For NYS Business Reopening Safety Plan Template and Construction Master Guidance Plan please refer to below links:

[https://www.governor.ny.gov/sites/governor.ny.gov/files/atoms/files/NYS\\_BusinessReopeningSafetyPlanTemplate.pdf](https://www.governor.ny.gov/sites/governor.ny.gov/files/atoms/files/NYS_BusinessReopeningSafetyPlanTemplate.pdf)

<https://www.governor.ny.gov/sites/governor.ny.gov/files/atoms/files/ConstructionMasterGuidance.pdf>

### E. For additional resources:

OSHA COVID-19 Resources

OSHA Guidance on Preparing Workplaces for COVID-19

DOL COVID-19 Resources

Interim Guidance for Business and Employers

Centers for Disease Control - - <https://www.cdc.gov/coronavirus/2019-ncov/index.html>

*The Bidder agrees it is responsible for complying with any and all health and safety requirements issued by federal, state or local entities, including but not limited to New York State Governor Office Executive Orders, New York State Department of Health rules, regulations and guidance, and other New York State,*



SECTION 01 31 50 – COVID-19 CONTRACTOR COMPLIANCE

*Fund or Campus laws, rules, regulations or requirements that exist or may be issued and/or amended during the bidding and/or performance of work on this Project.*

*With respect to the COVID-19 pandemic, Bidder specifically acknowledges and agrees that the NYS DOH Interim COVID-19 Guidance for Construction Projects, "Guidance", in effect at the time of bid is made a part of the contract work for this Project, as set forth in General Requirements. Bidder affirms that all costs and time associated with compliance with the current Guidance are included in its bid. The current Guidance is available at the following website:*

<https://forward.ny.gov/industries-reopening-phase#phase-one-construction>

*Notwithstanding the foregoing, Bidder agrees to comply with the Guidance as it may be amended or superseded in the future.*

END OF SECTION 013150



## SECTION 01 32 16 – CONSTRUCTION PROGRESS SCHEDULE

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Each Prime Contractor shall develop a full schedule, in sufficient detail and clarity of form and technique so that the contractor can plan and control his work properly and the Construction Manager/Owner can readily monitor and follow the progress for all portions of the work. The Contractor shall complete the detailed schedule within 10 days after contract award.
- B. The schedule shall comply with the various limits imposed by the scope of work any by any contractually intermediate milestone dates and completion dates included in the contract.
- C. The activities identified in the schedule shall be analyzed in detail to determine activity time durations in units of whole working days. All durations shall be the result of definitive manpower and resource planning by the Contractor. The contractor will provide specific manpower loading information / crew size to support the duration proposed. (e.g. – 4-man crew can get 1000 sf / day project has 11000 sf; thus, duration was identified as 11 days)
- D. The activity data shall include activity codes to facilitate selection, sorting and preparation of summary reports and graphics. Activity codes shall be developed for:
  - 1. Area: Subdivision of the site into logical modules or blocks and levels.
  - 2. Responsibility: contractor or subcontractor responsible for the work.
  - 3. Specifications: 33 Division CSI format.
  - 4. System: Division of the work into building systems for summary purposes.
  - 5. Milestone: Work associated with completion of interim completion dates or milestones.
  - 6. Pay Item: Work identified with a pay item on the Schedule of Values.

#### 1.2 REPORTS

- A. For initial submittal and each update, the contractor shall prepare the following standard report:
  - 1. Tabular Schedule Report sorted by Activity code and Early Start.

#### 1.3 GRAPHICS

- A. For initial submittal the contractor shall prepare the following graphics:
  - 1. Pure logic diagram (Precedence Format) of entire data, not time scaled, grouped by Activity code.
  - 2. Detailed bar chart sorted by Activity Code with Early Start and Early Finish.
  - 3. Summary bar chart summarizing by Activity Code with Early Start and Early Finish.
- B. For each update the contractor shall prepare the following graphic:
  - 1. Bar Chart showing work activities with Early Start in the next 40 work days sorted by Activity Code and Early Start.
  - 2. Summary Bar Chart summarizing by Activity Code showing progress with Early Start and Early Finish.
- C. For each Change Order involving adjustment in the contract time for performance the contractor shall prepare a pure logic diagram showing the changed work with all predecessor and successor activities (Fragnet).

## SECTION 01 32 16 – CONSTRUCTION PROGRESS SCHEDULE

### 1.4 SUBMITTALS

- A. In no case shall first application for payment be approved prior to submission of acceptable preliminary schedule, detailed submittal schedule, and schedule of values.
- B. Monthly updates, required schedules and graphics shall be submitted to the Construction Manager/Owner within five working days following the end of the preceding month. Monthly updates, schedules and graphics shall be submitted in five copies.
- C. If any of the required submissions are returned to the Contractor for corrections or revisions, they shall be resubmitted within ten (10) calendar days after the return mailing date. Resubmittals shall be in the same quantities as noted above. Review and response by the Construction Manager/Owner will be given within (10) calendar days after resubmission.

### 1.5 PAYMENT WITHHELD

- A. If the Contractor fails to submit the required schedule information as indicated in this section within the time prescribed or revision thereof within the requested time, the Construction Manager/Owner may withhold approval of Progress Payment Estimates until such time as the Contractor submits the required information.

### 1.6 UPDATES

- A. Updates of the Schedule shall be made every two weeks reflecting actual or reasonably anticipated progress as of the last working day of the month. Monthly updates of the Detailed Schedule will be made each month until all work is substantially complete.
- B. The Contractor will meet with the Construction Manager/Owner at the end of the updated period to review information in draft form before preparation of the required schedules and graphics. The Contractor will present data, prepared in advance, for review and approval of the Construction Manager/Owner including:
  - 1. Actual Start Dates.
  - 2. Actual Completion Dates.
  - 3. Activity percent complete and/or Remaining Duration.
  - 4. Revised logic, changes in activity duration's or resource assignments.
  - 5. Narrative report discussing progress through the update period; changes, delays or other circumstances affecting progress; status of the project with respect to completion schedule; and any efforts by the Contractor to improve progress.
- C. The update meeting will establish the values to be submitted for payment and will be directly related to the schedule of values in the application for payment.
- D. The Contractor shall prepare a report of the meeting and make all changes, additions or corrections to the data resulting from the review. The contractor shall promptly prepare the monthly submittal following the update meeting.

### 1.7 CHANGES, DELAYS AND EXTENSIONS OF TIME

- A. When changes or delays are experienced, the Contractor shall submit to the Construction Manager/Owner a Time Impact Analysis illustrating the influence of each change or delay on the

## SECTION 01 32 16 – CONSTRUCTION PROGRESS SCHEDULE

current Contract scheduled completion date. Each time analysis shall include a Fragnet (network analysis) demonstrating how the Contractor proposed to incorporate the change or delay into the Detailed Schedule. Additionally, the analysis shall demonstrate the time impact based on the date the change was given to the Contractor, the status of construction at that point in time, and the activity duration of all effected activities. The activity duration used in this analysis shall be those included in the latest update of the Detailed Schedule, closest to the time of delay or as adjusted by mutual agreement.

- B. Each Time Impact Analysis shall be submitted within ten (10) calendar days after a delay occurs or a notice of change order is given to the Contractor. In cases where the Contractor does not submit a Time Impact Analysis for a specific change or delay with a specified period of time, it shall be mutually agreed that no time extension is required. Final evaluation of each Time Impact Analysis by the Construction Manager/Owner shall be made within fourteen (14) calendar days after receipt unless subsequent meetings and negotiations are necessary. Adjustments in the Contract time for performance shall be made only by written change order approved by the Owner. Upon approval of the Owner, Fragnets illustrating the influence of changes and delays shall be incorporated into the Detailed Schedule by the contractor during the first update after agreement is reached.
- C. The time difference between the Early Finish date and the Late Finish Date is defined as "float." The "float" belongs to the Project and may be used by the Construction Manager/Owner to benefit the Project. Changes or delays that influence activities in the network with "float" and do not extend the Critical Path (the network of activities with zero days "float") shall not be justification for an adjustment in Contract time for performance.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 013216



## SECTION 013233 – PHOTOGRAPHIC DOCUMENTATION

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

A. This Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.

B. Related Sections include the following:

1. Division 1 Section "Closeout Procedures" for submitting digital media as Project Record Documents at Project closeout.

#### 1.03 SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same label information as corresponding set of photographs.

B. Construction Photographs: Submit two prints of each photographic view within seven days of taking photographs.

1. Format: 4-by-6-inch smooth-surface matte prints on single-weight commercial-grade photographic paper, enclosed back to back in clear plastic sleeves that are punched for standard 3-ring binder.
2. Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:
  - a. Date photograph was taken if not date stamped by camera.
  - b. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
  - c. Unique sequential identifier.
3. Digital Images: Submit a complete set of digital image electronic files with each submittal of prints as a Project Record Document on CD-ROM. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as the sensor, uncropped.

#### 1.04 COORDINATION

A. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities, including temporary lighting required to produce clear, well-lit photographs without obscuring shadows.

#### 1.05 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

### PART 2 - PRODUCTS

#### 2.01 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in uncompressed TIFF format, produced by a digital camera with minimum sensor size of 4.0 megapixels, and at an image resolution of not less than 1024 by 768 pixels.

### PART 3 - EXECUTION

#### 3.01 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in filename for each image.
2. Field Office Images: Maintain one set of images on CD-ROM in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Architect.

C. Preconstruction Photographs: Before commencement of demolition, take color, digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.

1. Take eight photographs to show existing conditions adjacent to property before starting the Work.
2. Take twenty photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.



D. Periodic Construction Photographs: Take 12 color, digital photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

E. Architect-Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of color, digital photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

F. Final Completion Construction Photographs: Take eight color photographs after date of Substantial Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points.

1. Do not include date stamp.

END OF SECTION 013233



## SECTION 013300 – SUBMITTALS

### 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 submittals required for performance of the Work, including the following:
  - 1. Contractor's construction schedule.
  - 2. Submittal schedule.
  - 3. Daily construction reports.
  - 4. Shop Drawings.
  - 5. Product Data.
  - 6. Samples.
  - 7. Quality assurance submittals.
- B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:
  - 1. Permits.
  - 2. Applications for Payment.
  - 3. Performance and payment bonds.
  - 4. Insurance certificates.
  - 5. List of subcontractors.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section " Payment Procedures" specifies requirements for submittal of the Schedule of Values.
  - 2. Division 1 Section " Project Management and Coordination" specifies requirements governing preparation and submittal of required Coordination Drawings.
  - 3. Division 1 Section "Project Meetings" specifies requirements for submittal and distribution of meeting and conference minutes.
  - 4. Division 1 Section "Quality Requirements" specifies requirements for submittal of inspection and test reports.
  - 5. Division 1 Section "Execution and Closeout Requirements " specifies requirements for submittal of Project Record Documents and warranties at project closeout.
- D. The designated designer must be licensed in the state of New York.

#### 1.3 DEFINITIONS

- A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.
  - 1. Preparation of Coordination Drawings is specified in Division 1 Section "Project Management and Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.

- B. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.
- C. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

#### 1.4 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
    - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
  - 3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.
    - a. Submittals must be transmitted in accordance with the requirements of Section 1.6.
    - b. Allow between 10 and 15 business days for initial review of the first round of submittals. See 1.6 for more information. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals.
    - c. If an intermediate submittal is necessary, process the same as the initial submittal.
    - d. Allow an additional 10 business days for reprocessing each resubmittal.
    - e. No extension of Contract Time will be authorized because of contractor's failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
    - f. **If the contractor delays on key submittals which can negatively impact the project schedule, the owner and his agent(s) can withhold payments as necessary until the proper submittal paperwork is received.**
- B. Submittal Preparation:
  - 1. Each copy of each submittal will have a "submittal cover sheet" attached identifying all information requested by Architect. (see copy after this section) All SCS must be approved by contractor (see electronic stamp B.5) signed, dated and have all fields completely filled-out. Any submittal received without proper use of this Cover Sheet will be returned immediately to the contractor. Cover sheet for contractor's use is included at the end of this section.
  - 2. A Submittals Website, an internet (web-based) service shall be used by all contractors to provide an on-line database and repository which shall be used to transmit and track project related documents. The Submittals Website ( Sage ) is provided by the Construction Manager. Upon Contract award the successful bidders will be given log on instructions. The intent for using the Submittals Website is to expedite the construction process by reducing paperwork, improving information flow, and decreasing submittal review turnaround time.
  - 3. Project submittals (shop drawing, product data and quality assurance submittals) shall be transmitted by the Contractor in Portable Document Format (PDF) to the Submittals Website, where it will be tracked and stored for retrieval for review. After the submittal is

- reviewed it is uploaded back to the Submittals Website for action or use by the Contractor and Owners Representatives.
4. The service also tracks and stores documents related to the project such as RFI's (Request for Information), Contacts, Meeting Minutes, Punchlist, and Non-Compliance Notices.
  5. For each submittal, the Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents, including verification of manufacturer/product, dimensions and coordination of information with other parts of the work. (contractor sign and date)
  6. It is the Contractor's responsibility to provide the submittals in a PDF format. The contractor may use any of the following options:
    - a. Subcontractors and suppliers provide paper submittals to the Contractor, who electronically scans and converts them to PDF format.
    - b. Contract a Scanning Service, which will allow the Contractor and the Contractor's subcontractors and suppliers to provide paper submittals to the Scanning Service, which electronically scans and converts them to PDF format. It will be the Contractor's responsibility to transmit the scanned submittals to the Submittals Website.
  7. Image Quality:
    - a. Image resolution: The PDF files shall be created at a minimum resolution of 200 dots per inch utilizing the original document size. The Contractor will be responsible to increase the resolution of the scanned file or images being submitted as required to adequately presenting the information.
    - b. Image Color Rendition: When information represented requires color to convey the intent and compliance, provide full color PDF reproduction.
- C. Contractor Internet Service and Equipment Requirements:
1. The Contractor will be required to have an Email address and Internet access at Contractor's main office.
  2. Unless the Contractor will exclusively be using a Scanning Service to create all PDF documents, the Contractor will be required to own a PDF reviewing, creating and editing software, such as Adobe Acrobat ([www.adobe.com](http://www.adobe.com)), Bluebeam PDF Revu ([www.bluebeam.com](http://www.bluebeam.com)), or other similar PDF reviewing, creating and editing software for applying electronic stamps and comments.
  3. The Contractor will be required to have a web browser such as Internet Explorer 11, Firefox 30-51.
  4. The Contractor will be required to have Java Run Time Environment: Minimum Java version 8 update 121.
  5. The Contractor will be required to have Adobe Reader version 11: Sage uses a pdf creator to generate forms. In order to print / view forms you will need Adobe Reader.
  6. Contractors are required to have network securities in place such as anti-virus that is active and up to date. Do not access Contract Management from unsecured or public network location such as free WI-FI hotspots.
- D. Training and Support:
- a. A training manual shall be available, free of charge from the Construction Manager, for all project participants regarding use of the Submittals Website and PDF submittals.
  2. Training will be provided by the Construction Manager at Arris's main office located in Poughkeepsie NY. The appropriate personnel from each contractor office are required to attend this meeting.
- E. Paper Copies:
1. Contractor Copies: The Contractor will be responsible for making copies, for the Contractors own use and for use by its subcontractors and suppliers.

- F. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the CM electronically using a transmittal form. The CM will then transmit to the Architect. The Architect will not accept submittals received from sources other than the Construction Manager.
1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.
  2. Transmittal Form: Use AIA Document G810 and submit Sage notification to ACCI that the submittal has been uploaded. The contractor's transmittal must have the subject description properly filled out, so that all parties can see what section/product is being submitted without having to open the actual submittal.
  3. Transmittal Form: Use the sample form at the end of this Section for transmittal of submittals.

## 1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Distribution: It is the contractor's responsibility to coordinate submittals with each subcontracting trade. Each contractor shall be required to provide their subcontractors with a complete list of their submittals in order that other contractors can request required submittal information.
1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

## 1.6 SUBMITTAL SCHEDULE

- A. Submittals must be prepared and transmitted as follows, unless otherwise approved by the Construction Manager:
1. Within 15 working days after Notice to Proceed:
    - a. Rebar Shop Drawings
    - b. Metal Building shop drawings
    - c. HVAC units
    - d. Aluminum Windows
    - e. Electrical fixtures and panels
    - f. Door & Hardware submission
    - g. Asbestos Abatement submittals & Plan
    - h. All other submittals critical to the schedule.
  2. Balance of Submittals – after 15 days but within 30 days after Notice to Proceed.
  3. If the contractor misses the milestone submittal timeframes listed above, the owner / agents can withhold requisition payments until the required paperwork is received. **If there are any open submittals beyond 45 days of contract award, the owner will stop all contractor payments until all missing paperwork is received.**
  4. Upon approval by the Construction Manager, non-critical submittals may be transmitted later.
  5. Prepare submittals including information in paragraph 1.4B above.
- B. Schedule Updating: Revise the submittal schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

## 1.7 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report recording the following information concerning events at the site, and electronically submit one copy to the Architect and one copy to the Construction

Manager by 10:00 am the following day. Any contractor not submitting required reports will not receive approval on the subsequent application for payment until such time that all required information is submitted:

1. List of subcontractors at the site.
2. Count of personnel at the site (substantiates payroll).
3. High and low temperatures, general weather conditions.
4. Accidents and unusual events.
5. Meetings and significant decisions.
6. Stoppages, delays, shortages, and losses.
7. Meter readings and similar recordings.
8. Emergency procedures.
9. Orders and requests of governing authorities.
10. Change Orders received, implemented.
11. Services connected, disconnected.
12. Equipment or system tests and startups.
13. Partial Completions, occupancies.
14. Substantial Completions authorized.

## 1.8 SHOP DRAWINGS

- A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
- B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:
  1. Dimensions.
  2. Identification of products and materials included by sheet and detail number.
  3. Compliance with specified standards.
  4. Notation of coordination requirements.
  5. Notation of dimensions established by field measurement.
  6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches.
  7. All Technical Submittals:
    - a. Electronic shop drawing submittal to Construction Manager.
  8. Do not use Shop Drawings without an appropriate final stamp indicating action taken.
  9. Maintain approved copies on site to record "as-built" conditions.
  10. Submit additional copies of as-built, approved drawings as specified in project closeout.

## 1.9 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Submit prior to shop drawings or simultaneously when products are specified items or A/E approval is granted. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
  1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following that are not required, mark copies to indicate the applicable information. Include the following information:
    - a. Manufacturer's printed recommendations.
    - b. Compliance with trade association standards.
    - c. Compliance with recognized testing agency standards.

- d. Application of testing agency labels and seals.
- e. Notation of dimensions verified by field measurement.
- f. Notation of coordination requirements.
- 2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
- 3. Submit digitally through the Submittals Website to CM.
- 4. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
  - a. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
  - b. Do not permit use of unmarked copies of Product Data in connection with construction.

#### 1.10 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern. Sample are submitted directly to the architects home office and copy Construction Manager with transmittal.
  - 1. Mount or display Samples in the manner to facilitate review of qualities indicated. Prepare Samples to match the Architect's sample. Include the following:
    - a. Specification Section number and reference.
    - b. Generic description of the Sample.
    - c. Sample source.
    - d. Product name or name of the manufacturer.
    - e. Compliance with recognized standards.
  - 2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
    - a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
    - b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
    - c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
    - d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.
  - 3. Preliminary Submittals: Submit a full set of choices where Samples are required for selection of color, pattern, texture, or similar characteristics from a range of standard and premium choices.
    - a. The Architect will review and distribute selections made or other action.
  - 4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 6 sets to the



Architect who will distribute one set to CM and two (2) to the contractor marked with the action taken.

5. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.
  - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
  - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
  1. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.
    - a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

#### 1.11 QUALITY ASSURANCE SUBMITTALS

- A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.
- B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.
  1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.
- C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1 Section "Quality Control."

#### 1.12 ARCHITECT'S ACTION

- A. Except for submittals for the record or information, where action and return is required, the Architect will review each submittal, mark to indicate action taken, and return promptly.
  1. Compliance with specified characteristics is the Contractor's responsibility, as stated on the approval stamp.
- B. Action Stamp: The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp appropriately to indicate the action taken, as follows:
  1. Unsolicited Submittals: The Architect will return unsolicited submittals to the sender without action.
  2. Final Unrestricted Release: When the Architect marks a submittal "Furnish as Corrected", the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
  3. Final-But-Restricted Release: When the Architect marks a submittal "Make Corrections Noted", the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance. (No resubmittal is required.)

4. "Revise and Resubmit" When the Architect marks a submittal "Revise and Resubmit", do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay.
5. Returned for Resubmittal: When the Architect marks a submittal "Rejected", do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary, to obtain different action mark.
  - a. Do not use, or allow others to use, submittals marked "Rejected" at the Project Site or elsewhere where Work is in progress.
6. Other Action: Where a submittal is for information or record purposes only and does require approval and the contractor is responsible for the conformance of the product, the Architect will return the submittal marked "Reviewed".
7. "Submit specified item": When submittal is marked "Submit Specified Item", the Contractor shall immediately submit the specified item,

PART 2 - EXECUTION (Not Applicable)

END OF SECTION 013300

## SECTION 014000 – QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Contractor is responsible for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner/Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Sections include the following:
  - 1. Division 1 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
  - 2. Technical Sections for specific test and inspection requirements.

#### 1.03 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Construction Manager.
- C. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

- E. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
  - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- I. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five (5) previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

#### 1.04 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect in writing for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision in writing before proceeding.

#### 1.05 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  - 1. Specification Section number and title.
  - 2. Description of test and inspection.
  - 3. Identification of applicable standards.
  - 4. Identification of test and inspection methods.
  - 5. Number of tests and inspections required.
  - 6. Time schedule or time span for tests and inspections.
  - 7. Entity responsible for performing tests and inspections.
  - 8. Requirements for obtaining samples.

9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

#### 1.06 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
  2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

## 1.07 QUALITY CONTROL

- A. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  2. Notify testing agencies at least twenty-four (24) hours in advance of time when Work that requires testing or inspecting will be performed.
  3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.

4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- B. **Manufacturer's Field Services:** Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."
- C. **Retesting/Reinspecting:** Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. **Testing Agency Responsibilities:** Cooperate with Architect, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform any duties of Contractor.
- E. **Associated Services:** Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- F. **Coordination:** Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- G. **Schedule of Tests and Inspections:** Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within sixty (60) days of date established for the Notice to Proceed.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.01 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
  1. Date test or inspection was conducted.
  2. Description of the Work tested or inspected.
  3. Date test or inspection results were transmitted to Architect.
  4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

### 3.02 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
  2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000



## SECTION 014533 – CODE-REQUIRED SPECIAL INSPECTIONS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Code-required special inspections.
- B. Submittals.

#### 1.02 RELATED REQUIREMENTS

- A. Section 013300 - Submittal procedures.
- B. Section 014000 - Quality Requirements.
- C. Section 016000 - Product Requirements: Requirements for material and product quality.

#### 1.03 DEFINITIONS

- A. Code or Building Code: ICC (IBC), 2020 Building Code of New York with New York State supplements and specifically, Chapter 17 - Special Inspections and Tests.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. National Institute of Standards and Technology (NIST).
- D. Special Inspection:
  - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved contract documents and the referenced standards.
  - 2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

#### 1.04 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
- B. AISC 360 - Specification for Structural Steel Buildings; 2010.
- C. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2012.
- D. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete; 2010.
- E. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and

Construction; 2012a.

- F. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing; 2014a.
- G. ASTM E605 - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2011).
- H. ASTM E736 - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2000 (Reapproved 2011).
- I. ASTM E2570 - Standard Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings Used under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage; 2007.
- J. AWCI 125 - Technical Manual 12-B: Standard Practice for the Testing and Inspection of Field-Applied Thin Film Intumescent Fire-Resistance Materials; 1998.
- K. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- L. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.
- M. ICC (IBC) - International Building Code; 2020.

#### 1.05 SUBMITTALS

- A. See Section 013300 - Submittal procedures.
- B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency shall:
  - 1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
  - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
  - 3. Submit certification that Special Inspection Agency is acceptable to AHJ.
- C. Smoke Control Testing Agency Qualifications: Prior to the start of work, the Testing Agency shall:
  - 1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
  - 2. Submit documentary evidence that agency has appropriate credentials and documented experience in fire protection engineering, mechanical engineering and HVAC air balancing.
  - 3. Submit certification that Testing Agency is acceptable to AHJ.
- D. Special Inspection Reports: After each special inspection, Special Inspector shall promptly submit two copies of report; one to Architect and one to the AHJ.
  - 1. Include:
    - a. Date issued.

- b. Project title and number.
- c. Name of Special Inspector.
- d. Date and time of special inspection.
- e. Identification of product and specifications section.
- f. Location in the Project.
- g. Type of special inspection.
- h. Date of special inspection.
- i. Results of special inspection.
- j. Conformance with Contract Documents.

#### 1.06 SPECIAL INSPECTION AGENCY

- A. Owner will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

### PART 2 PRODUCTS - NOT USED

### PART 3 EXECUTION

#### 3.1 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

- A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
  - 1. Continuous Special Inspection: Special Inspection Agency shall be present in the area where the work is being performed and observe the work at all times the work is in progress.
  - 2. Periodic Special Inspection: Special Inspection Agency shall be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.
- B. Special inspections required by Section 1705 may not be required where the work is done on the premises of a fabricator registered and approved to perform such work without special inspection. Approval shall be based upon review of the fabricator's written procedural and quality control manuals and periodic auditing of fabrication practices by an approved special inspection agency. At completion of fabrication, the approved fabricator shall submit a certificate of compliance to the building official stating that the work was performed in accordance with the approved construction documents

#### 3.2 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION

- A. Special inspection for structural steel shall be in accordance with the quality assurance inspection requirements of AISC 360
- B. High-Strength Bolting Installation: Verify items listed below comply with AISC 360, Section M2.5.

1. Snug tight joints; periodic.
- C. Welding:
  1. Reinforcing Steel: Verify items listed below comply with AWS D1.4/D1.4M and ACI 318, Section 3.5.2.
    - a. Verification of weldability; periodic.
    - b. Other reinforcing steel; periodic.
- D. Steel Frame Joint Details: Verify compliance with approved contract documents.
  1. Details, bracing and stiffening; periodic.
  2. Member locations; periodic.
  3. Application of joint details at each connection; periodic.

### 3.3 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

- A. Reinforcing Steel and Placement: Verify compliance with approved contract documents and ACI 318, Sections 3.5 and 7.1 through 7.7; periodic.
- B. Reinforcing Steel Welding: Verify compliance with AWS D1.4/D1.4M and ACI 318, Section 3.5.2; periodic.
- C. Design Mix: Verify plastic concrete complies with the design mix in approved contract documents and with ACI 318, Chapter 4 and 5.2; periodic.
- D. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172/C172M, ASTM C31/C31M and ACI 318, Sections 5.6 and 5.8 and record the following, continuous:
  1. Slump.
  2. Air content.
  3. Temperature of concrete.
- E. Specified Curing Temperature and Techniques: Verify compliance with approved contract documents and ACI 318, Sections 5.11 through 5.13; periodic.
- F. Concrete Strength in Situ: Verify concrete strength complies with approved contract documents and ACI 318, Section 6.2, for the following.
- G. Formwork Shape, Location and Dimensions: Verify compliance with approved contract documents and ACI 318, Section 6.1.1; periodic.

### 3.8 SPECIAL INSPECTIONS FOR SMOKE CONTROL

- A. Test smoke control systems as follows:
  1. Record device locations and test system for leakage after erection of ductwork but before starting construction that conceals or blocks access to system.
  2. Test and record pressure difference, flow measurements, detection function and controls after system is complete and before structure is occupied.

### 3.9 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

#### A. Special Inspection Agency shall:

1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
2. Perform specified sampling and testing of products in accordance with specified reference standards.
3. Ascertain compliance of materials and products with requirements of Contract Documents.
4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of work or products.
5. Perform additional tests and inspections required by Architect.
6. Submit reports of all tests or inspections specified.

A. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.

B. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

### 3.10 CONTRACTOR DUTIES AND RESPONSIBILITIES

#### A. Contractor Responsibilities, General:

1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
2. Cooperate with agency and laboratory personnel; provide access to the work, to manufacturers' facilities, and to fabricators' facilities.
3. Provide incidental labor and facilities:
  - a. To provide access to work to be tested or inspected.
  - b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
  - c. To facilitate tests or inspections.
  - d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

# Statement of Special Inspections

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Project: *New Maintenance Building*

Location: *Westlake High School*

Owner: *Mount Pleasant Central School District*

Design Professional in Responsible Charge:

This *Statement of Special Inspections* is submitted as a condition for permit issuance in accordance with the Special Inspection and Structural Testing requirements of the Building Code. It includes a schedule of Special Inspection services applicable to this project as well as the name of the Special Inspection Coordinator and the identity of other approved agencies to be retained for conducting these inspections and tests. This *Statement of Special Inspections* encompass the following disciplines:

☒ Structural      ☐ Mechanical/Electrical/Plumbing  
☒ Architectural      ☐ Other: \_\_\_\_\_

The Special Inspection Coordinator shall keep records of all inspections and shall furnish inspection reports to the Building Official and the Registered Design Professional in Responsible Charge. Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

Interim reports shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge.

A *Final Report of Special Inspections* documenting completion of all required Special Inspections, testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy.

Job site safety and means and methods of construction are solely the responsibility of the Contractor.

Interim Report Frequency: \_\_\_\_\_ or ☐ per attached schedule.

Prepared by:

\_\_\_\_\_  
(type or print name)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

*Design Professional Seal*

Owner's Authorization:

Building Official's Acceptance:

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**CASE Form 101** • Statement of Special Inspections • ©CASE 2004

# Schedule of Inspection and Testing Agencies

This Statement of Special Inspections / Quality Assurance Plan includes the following building systems:

- ☒ Soils and Foundations
- ☒ Cast-in-Place Concrete
- ☒ Precast Concrete
- ☒ Masonry
- ☒ Structural Steel
- ☐ Cold-Formed Steel Framing

- ☒ Spray Fire Resistant Material
- ☐ Wood Construction
- ☐ Exterior Insulation and Finish System
- ☐ Mechanical & Electrical Systems
- ☐ Architectural Systems
- ☐ Special Cases

Special Inspection Agencies	Firm	Address, Telephone, e-mail
1. <b>Special Inspection Coordinator</b>		
2. Inspector		
3. Inspector		
4. Testing Agency		
5. Testing Agency		
6. Other		

Note: The inspectors and testing agencies shall be engaged by the Owner or the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official, prior to commencing work.

Item	Agency # (Qualif.)	Scope
1. Shallow Foundations	PE/GE	<i>Inspect soils below footings for adequate bearing capacity and consistency with geotechnical report.</i>  <i>Inspect removal of unsuitable material and preparation of subgrade prior to placement of controlled fill</i>
2. Controlled Structural Fill	PE/GE	<i>Perform sieve tests (ASTM D422 &amp; D1140) and modified Proctor tests (ASTM D1557) of each source of fill material.</i>  <i>Inspect placement, lift thickness and compaction of controlled fill.</i>  <i>Test density of each lift of fill by nuclear methods (ASTM D2922)</i>  <i>Verify extent and slope of fill placement.</i>



Item	Agency # (Qualif.)	Scope
1. Mix Design	ACI-CCI ICC-RCSI	Review concrete batch tickets and verify compliance with approved mix design. Verify that water added at the site does not exceed that allowed by the mix design.
2. Material Certification		
3. Reinforcement Installation	ACI-CCI ICC-RCSI	Inspect size, spacing, cover, positioning and grade of reinforcing steel. Verify that reinforcing bars are free of form oil or other deleterious materials. Inspect bar laps and mechanical splices. Verify that bars are adequately tied and supported on chairs or bolsters
4. Welding of Reinforcing	AWS-CWI	Visually inspect all reinforcing steel welds. Verify weldability of reinforcing steel. Inspect preheating of steel when required.
5. Anchor Rods		Inspect size, positioning and embedment of anchor rods. Inspect concrete placement and consolidation around anchors.
6. Concrete Placement	ACI-CCI ICC-RCSI	Inspect placement of concrete. Verify that concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated.
7. Sampling and Testing of Concrete	ACI-CFTT ACI-STT	Test concrete compressive strength (ASTM C31 & C39), slump (ASTM C143), air-content (ASTM C231 or C173) and temperature (ASTM C1064).
8. Curing and Protection	ACI-CCI ICC-RCSI	Inspect curing, cold weather protection and hot weather protection procedures.

Item	Agency # (Qualif.)	Scope
1. Plant Certification / Quality Control Procedures <input type="checkbox"/> Fabricator Exempt	ACI-CCI ICC-RCSI	Review plant operations and quality control procedures.
2. Mix Design	ACI-CCI ICC-RCSI	Inspect concrete batching operations and verify compliance with approved mix design
3. Material Certification		
4. Reinforcement Installation	ACI-CCI ICC-RCSI	Inspect size, spacing, position and grade of reinforcing steel. Verify that reinforcing bars are free of form oil or other deleterious materials.
5. Prestress Operations	ICC-PCSI	Inspect placement, stressing, grouting and protection of prestressing tendons
6. Connections / Embedded Items		
7. Formwork Geometry		
8. Concrete Placement	ACI-CCI ICC-RCSI	Inspect placement of concrete. Verify that concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated .
9. Sampling and Testing of Concrete	ACI-CFTT ACI-STT	Test concrete compressive strength (ASTM C31 & C39), slump (ASTM C143), air-content (ASTM C231 or C173) and temperature (ASTM C1064).
10. Curing and Protection	ACI-CCI ICC-RCSI	Inspect curing, cold weather protection and hot weather protection procedures.
11. Erected Precast Elements	PE/SE	Inspect erection of precast concrete including member configuration, connections, welding and grouting.

Item	Agency # (Qualif.)	Scope
1. Material Certification		
2. Mixing of Mortar and Grout	ICC-SMSI	<i>Inspect proportioning, mixing and retempering of mortar and grout.</i>
3. Installation of Masonry	ICC-SMSI	<i>Inspect size, layout, bonding and placement of masonry units.</i>
4. Mortar Joints	ICC-SMSI	<i>Inspect construction of mortar joints including tooling and filling of head joints.</i>
5. Reinforcement Installation	ICC-SMSI AWS-CWI	<i>Inspect placement, positioning and lapping of reinforcing steel.</i> <i>Inspect welding of reinforcing steel.</i>
6. Grouting Operations	ICC-SMSI	<i>Inspect placement and consolidation of grout. Inspect masonry clean-outs for high-lift grouting.</i>
7. Weather Protection	ICC-SMSI	<i>Inspect cold weather protection and hot weather protection procedures. Verify that wall cavities are protected against precipitation.</i>
8. Evaluation of Masonry Strength	ICC-SMSI	<i>Test compressive strength of mortar and grout cube samples (ASTM C780).</i> <i>Test compressive strength of masonry prisms (ASTM C1314).</i>
9. Anchors and Ties	ICC-SMSI	<i>Inspect size, location, spacing and embedment of dowels, anchors and ties.</i>
10. Anchors and Ties	ICC-SMSI	<i>Inspect size, location, spacing and embedment of dowels, anchors and ties.</i>

Item	Agency # (Qualif.)	Scope
1. Fabricator Certification/ Quality Control Procedures <input type="checkbox"/> Fabricator Exempt	AWS/AISC- SSI ICC-SWSI	<i>Review shop fabrication and quality control procedures.</i>
2. Material Certification	AWS/AISC- SSI ICC-SWSI	<i>Review certified mill test reports and identification markings on wide-flange shapes, high-strength bolts, nuts and welding electrodes</i>
3. Open Web Steel Joists		<i>Inspect installation, field welding and bridging of joists.</i>
4. Bolting	AWS/AISC- SSI ICC-SWSI	<i>Inspect installation and tightening of high-strength bolts. Verify that splines have separated from tension control bolts. Verify proper tightening sequence. Continuous inspection of bolts in slip-critical connections.</i>
5. Welding	AWS-CWI  ASNT	<i>Visually inspect all welds. Inspect pre-heat, post-heat and surface preparation between passes. Verify size and length of fillet welds.</i>  <i>Ultrasonic testing of all full-penetration welds.</i>
6. Structural Details	PE/SE	<i>Inspect steel frame for compliance with structural drawings, including bracing, member configuration and connection details.</i>
7. Metal Deck	AWS-CWI	<i>Inspect welding and side-lap fastening of metal roof and floor deck.</i>

## Spray-Applied Fire Resistant Material

Page      of

Item	Agency # (Qualif.)	Scope
1. Material Specifications		
2. Laboratory Tested Fire Resistance Design	ICC-SFSI	<i>Review UL fire resistive design for each rated beam, column, or assembly.</i>
3. Schedule of Thickness	ICC-SFSI	<i>Review approved thickness schedule.</i>
4. Surface Preparation	ICC-SFSI	<i>Inspect surface preparation of steel prior to application of fireproofing</i>
5. Application	ICC-SFSI	<i>Inspect application of fireproofing.</i>
6. Curing and Ambient Condition	ICC-SFSI	<i>Verify ambient air temperature and ventilation is suitable for application and curing of fireproofing.</i>
7. Thickness	ICC-SFSI	<i>Test thickness of fireproofing (ASTM E605). Perform a set of thickness measurements for every 1,000 SF of floor and roof assemblies and on not less than 25% of rated beams and columns.</i>
8. Density	ICC-SFSI	<i>Test the density of fireproofing material (ASTM E605).</i>
9. Bond Strength	ICC-SFSI	<i>Test the cohesive/adhesive bond strength of fireproofing ASTM E736). Perform not less than one test for each 10,000 SF.</i>

END OF SECTION 014533



## SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

### PART I - GENERAL

#### 1.1 SUMMARY

- A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.
- B. Temporary utilities include, but are not limited to, the following:
  - 1. Sewers / septic and drainage.
  - 2. Water Service and distribution.
  - 3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
  - 4. Ventilation.
  - 5. Electric power service.
  - 6. Lighting.
  - 7. Temporary Heating.
- C. Security and protection facilities include, but are not limited to, the following:
  - 1. Environmental protection.
  - 2. Stormwater control.
  - 3. Site enclosure fence.
  - 4. Security enclosure and lockup.
  - 5. Barricades, warning signs, and lights.
  - 6. Temporary enclosures.
  - 7. Temporary partitions.
  - 8. Fire protection.
- D. Unless work of this section is indicated to be provided under a specific contract, each Prime Contractor must provide, maintain and remove required temporary facilities necessary to perform his own construction activities.
- E. Accessible Temporary Egress: Comply with applicable provisions in ICC/ANSI A117.1.

#### 1.2 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
  - 1. Building code requirements.
  - 2. Health and safety regulations.
  - 3. Utility company regulations.
  - 4. Police, fire department, and rescue squad rules.
  - 5. Environmental protection regulations.
  - 6. NYS SED 155.5

## SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

- B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."
- 1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

### 1.3 PROJECT CONDITIONS

- A. Temporary Utilities: Each contractor will prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-preventive measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist onsite.

### 1.4 DIVISION OF RESPONSIBILITIES

- A. General: These Specifications assign the Contractor responsibilities.
- B. Each Prime Contractor is responsible for the following:
  - 1. Installation, operation, maintenance and removal of each temporary facility considered as its own normal construction activity, as well as the costs and use charges except as listed below.
  - 2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
  - 3. Its own storage, Conex boxes and fabrication sheds. (Locate / Move as directed by CM)
  - 4. Hoisting requirements, including hoisting loads in excess of 2 tons, hoisting material or equipment into spaces below grade, and hoisting requirements outside the building enclosure. (Rigging insurance must be provided when contractor hoisting equipment)
  - 5. Collection and disposal of its own hazardous, dangerous, unsanitary, and all waste material.
  - 6. Secure lock-up of its own tools, materials and equipment.
  - 7. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.
  - 8. Maintaining temporary facilities provided by Contractor.
  - 9. Complying with the regulations of the Commissioner of Education - 8 NYCRR 155.5 - Uniform Safety Standards for School Construction and Maintenance Projects specified in Division 1 Section "01 50 00 – Uniform Safety Standards for School Construction."
  - 10. Containers for non-hazardous waste and debris generated by their own demolition and construction operations.



## SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

### 1.5 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to Owner, Architect or Construction Manager and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
  - 1. The Architect and Construction Manager
  - 2. Other Contractors.
  - 3. Owners construction forces, including testing agencies
  - 4. Personnel of authorities having jurisdiction.
- B. Water Service: Use water from the Owner's existing water system without metering and without payment of use charges. Access to water shall be approved by the Owner.
- C. Electric Power Service: Temporary electric power including set-up and maintenance is the responsibility of the Electrical Contractor. Use charges by owner

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Provide new materials. If acceptable to the Architect / CM, the Contractor may use undamaged, previously used materials in good condition. Provide materials suitable for use intended.
- B. Lumber and Plywood:
  - 1. For signs and directory boards, provide exterior-type, Grade B-B high density concrete form overlay plywood of sizes and thicknesses indicated.
  - 2. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch-thick exterior plywood.
- C. Paint: Paint surfaces exposed to view from Owner occupied areas.
- D. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.
- E. Temporary Roofing – minimum ½" gypsum sheeting and 30 mil reinforced EPDM membrane.

### 2.2 EQUIPMENT

- A. Water Hoses: Provide 3/4-inch, heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
- B. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.

## SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

### PART 3 - EXECUTION

#### 3.1 TEMPORARY UTILITY INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve Protect adequately and result in minimum interference with performance of the work. Relocate and modify facilities as required.
- B. Contractor shall provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
  - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

#### 3.2 CONTRACTOR FIELD OFFICES

- A. Space is severely limited. Contractor may with permission from the Owner and construction manager establish a field office for their own use. Said offices for the individual prime contractor, sub contractors, specialty contractors and the like shall be of such size and design as approved by the owner and architect and shall be located in the Construction Managers designated staging area. Each representative contractor will arrange for telephone service and electric service, if required, directly with the utility company. (No field offices or storage trailers will be allowed by the buildings.)
- B. Maintain, in the contractor's field office, all articles for First Aid treatment. The contractor shall also establish standing arrangements for the immediate removal and hospital treatment of any employees and other persons on the job site who may be injured or who may become ill during the course work.

#### 3.3 TEMPORARY AND PERMANENT SERVICES, GENERAL

- A. The Contractor's use of any permanent system or service of the building or portions thereof shall be subject to the Owners approval.
- B. The Contractor shall be responsible for any and all damage to permanent services used, and shall make good any and all damage to the satisfaction of the owner, prior to final completion and acceptance.
- C. NOTE - In accordance with OSHA and other applicable regulations, the representative Contractors performing erection of "skeleton" type work are solely responsible for the netting, guard rail protection and such other safety devices as deemed necessary to protect the workers and public from harm.

#### 3.4 TEMPORARY LIGHT AND POWER

- A. Temporary Electric Power Service: **Electrical Contractor** shall provide and pay all costs to provide a weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics to accommodate performance of work during the construction period.
  - 1. Responsibility: All work under this section to be provided by the **Electrical Contractor**.

## SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

2. Applicability: This section applies to all renovation and new construction work areas for this Project.
3. Electrical Contractor shall make arrangements with utility company for temporary and permanent services immediately after award of contract.
4. Temporary or permanent services for temporarily or permanently installed building equipment such as sump pumps, boilers, cabinet heating and/ or cooling units and fans shall be furnished, installed, operated and maintained so that the said equipment may be operated for drainage and temporary heat when required and/ or when so ordered by the Architect/ Construction Manager.
5. **Electrical Contractor shall maintain all parts of the electrical system (temporary and permanent) active and in-service at all times throughout the contract duration.** All temporary lighting to be controlled by standard switches per code (outside of power panels).
6. Electrical Contractor shall maintain power during the hours established by Construction Manager.
7. 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. Comply with all NECA, NEMA and UL Standards
8. Provide temporary service with an automatic ground-fault interrupter feature, activated from the circuits of the system.
9. Power Distribution System: Provide circuits of adequate size and proper characteristics for each use. In general run wiring overhead. Rise vertically where wiring will be least exposed to damage from construction operations.
10. Provide metal conduit, tubing or armored cable for protection of temporary power wiring where exposed to possible damage during construction operations. Where permitted by code, wiring of circuits not exceeding 110-120 Volt 20 Amp rating and wiring of lighting circuits may be non-metallic sheathed cable in areas where located overhead and exposed. Do not wire temporary lighting with plain, exposed (insulated) electrical conductors. Provide metal enclosures or boxes for wiring devices.
11. Provide overload-protected disconnect switch as required by code.
12. For power hand tools and task lighting, provide temporary 4-gang outlets at each floor level, spaced so that a 100-foot extension cord can reach each work area. Provide separate 110-120 Volt, 20 Amp circuit for each 4-gang outlet (4 outlets per circuit).
13. Maintaining all existing systems, including but not limited to, power, lighting, fire alarm, intercom, etc., within the existing building operational at all times for Owner occupancy and construction.

### B. TEMPORARY ELECTRICAL AND TELEPHONE SERVICES

1. Temporary Power Source: At each building / renovation area, use the existing electrical power distribution system for temporary power source.
2. Owner's Requirements: Do not disrupt the Owner's needs for continuous power at each building.
3. Electrical Contractor shall provide temporary power and lighting facilities for use of all trades. All temporary light and power shall be in accordance with the required Codes and Safety Standards.

## SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

4. Electrical Contractor will include in their base bid: Construction Manager trailer disconnect and wire removal at conclusion of the project.
5. All other contractor trailer use / connection charges for power and telephone to be paid for by the respective contractor.

### C. RECEPTACLE REQUIREMENTS

1. General Requirements: Provide temporary receptacle outlets as required Minimum Requirements: Provide a minimum of one quad 120-volt receptacle per 2500 square feet of building floor area, with maximum spacing of 50 feet on center for operation of portable tools and appliances during the construction period.
2. Branch Circuits: All temporary receptacle branch circuits to be rated 20 amps with a maximum of (3) duplex receptacles per circuit. Temporary receptacle branch circuits shall be independent of temporary lighting circuits.

### D. LIGHTING REQUIREMENTS

1. General Requirements: Electrical Contractor shall provide both interior and exterior lighting at areas where existing lighting has been removed and at new construction areas, as required to provide adequate illumination for safe and proper construction operations and Project Site security.
2. Minimum Requirements: Provide illumination levels adequate for construction operations and safe traffic conditions. As a minimum provide one 200-watt lamp per 400 square feet of building floor area, with maximum spacing of 20 feet. Any rooms in excess of 500 sf will receive one 400-watt metal halide fixture for each 1000 sf of area.
3. Stairways: Provide one 200-watt lamp per landing at each stairway and covered walkway.
4. Supplemental Lighting: If required, supplemental lighting beyond minimum requirements shall be provided via suitable portable lighting units with cord and plugs, and shall be paid for by the Contractor or Sub- Contractor requiring such additional lighting.
5. Restrictions: Do not use permanent lighting systems for temporary construction lighting purposes.

### E. MAXIMUM LOADS

1. General: Lighting and power loads connected to the temporary power distribution system shall be limited to the following maximum individual loads:

a.	Load Type	Maximum
b.	120 volt, 1-phase	1.5 KVA
c.	208 volt, 1-phase	2.5 KVA
d.	208 volt, 3-phase	5.0 KVA
2. General: The temporary power distribution system shall be sufficiently sized to provide temporary power as required within this section. Meter and Meter connections to be part of electrical contractors' base bid.

### F. ELECTRICAL WELDERS

1. Separate Power Sources Required: Power for electric welders and for other loads larger than the maximum allowable sizes shall be taken from portable power sources provided, paid for and operated by the Contractor or Sub-Contractor requiring the use of such equipment. Remove such power sources when no longer needed.

## SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

### G. ELECTRICAL ENERGY COSTS

1. Paid By Owner: Charges for electrical energy usage for temporary power and lighting will be paid by the Owner, when taken from the Owner's electrical services. Contractor and Sub-Contractors shall exercise measures to conserve energy usage. Use of owner electric for items not specific to project (e.g. heating construction shanties, etc.) will not be permitted

### 3.5 TEMPORARY TOILET FACILITIES

- A. Sanitary Facilities: Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with governing regulations including safety and health codes for the type, number, location, operation and maintenance of fixtures and facilities; provide not less than specified requirements. Install in locations which will best serve the project's needs. Existing facilities should not be used.
- B. Responsibilities: The **General Contractor** is responsible for temporary sanitary facilities and their maintenance, cleaning and supplies for use by all trades. Sufficient quantity/locations to properly handle the amount of workers onsite.
- C. Supply and maintain toilet tissue, paper towels, paper cups and other disposable materials as appropriate for each facility, including Owner's Representative's temporary offices for full contract duration. Provide covered waste containers for used material.
- D. Provide separate toilet facilities for male and female construction personnel.

### 3.6 TEMPORARY HEATING

- A. The **Mechanical Contractor** will maintain 60-degree temperature in all areas via temporary or permanent systems. The Mechanical Contractor will submit a detailed plan including sketches indicating his proposed temporary heating system for engineer approval within 4 weeks of contract award. The **Electrical Contractor** will provide permanent or temporary power for Mechanical Contractor's units for temporary heating. The fuel, equipment, materials, operating personnel and methods used therefore shall be at all times satisfactory to the Architect and Construction Manager and adequate for the purpose intended. The use of electric heaters is not acceptable. All required fuel is part of the Mechanical contract.
- B. The Contractor shall maintain the critical installation temperatures provided in the technical provisions of the specifications herein for all work in those areas where same is being performed.
- C. The maintenance of proper heating, ventilation and adequate drying out of the work is the responsibility of the contractor and any work damaged by dampness, insufficient or abnormal heating, shall be replaced to the satisfaction of the Architect by and at the sole expense of the contractor.
- D. Before and during the placing of gypsum and the application of other interior finishes, taping, varnishing, painting, etc. and until final acceptance by the Owner of all work covered by the Contract, the contractor shall, unless otherwise specified in the contract documents, maintain a temperature of 65 degrees F. Coordinate with Division 9 of the Technical Specifications.
- E. Use of the permanent system, **if approved by engineer and owner permission granted, shall not shorten, or negate any equipment, or system guarantees** required under this contract. (the warranty period starts upon date of substantial completion).

## SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

Two additional filter changes are to be provided by Mechanical Contract. A program of use, maintenance and restoration will be submitted with request for use of systems for temporary services.

### 3.7 TEMPORARY WATER

A. The **Plumbing** Contractor shall:

1. Provide and maintain a temporary water system of size and capacity as required below to supply the needs of all Contractors for the work.
2. Provide no less than two 3/4-inch hose bibs conveniently located at each building wing.
3. Provide and pay for all connections and permits.
4. Protect temporary and permanent lines against any damage.
5. Water source is only available from building. If contractor decides distance is too far he should use water storage tanks or truck at no additional charge to the owner.

B. Each Contractor shall:

1. Provide all hose and other extensions from connections installed by the Plumbing Contractor and all labor, materials and supplies required to supply water to the work.
2. Prevent water damage to the work.

### 3.8 STORAGE FACILITIES

- A. Each Contractor shall provide temporary storage shanties, tool houses and other facilities as required for their own use. Temporary structures shall be located at the Construction Manager's designated staging area, and shall be removed upon completion of the work or when directed.
- B. Materials delivered to the site shall be safely stored and adequately protected against loss or damage in watertight, lockable, Conex boxes. Particular care shall be taken to protect and cover materials that are liable to be damaged by the elements.
- C. Due to limited on site storage space, each Contractor shall coordinate delivery of his materials with the Construction Manager who will determine when large deliveries shall be made and shall be designate storage locations on site for delivered materials. All stored materials must be stored in locked, watertight trailers, paid for by applicable contractor.

### 3.9 SCAFFOLDING AND STAGING

- A. All scaffold, staging and appurtenances thereto shall comply in total to the requirements of Safety and Health Regulations for Construction Chapter XVII of OSHA, Part 1926 and all related amendments.

### 3.10 RUBBISH CONTAINER

- A. Each Contractor shall provide suitable rubbish container device(s) for his own use (both demolition and construction debris), properly maintained and serviced, replaced as required and protected from access by the public fencing as may be specified herein or approved by the Architect or Construction Manager.
- B. Contractor and Subcontractor shall sweep up and gather together daily all his own rubbish and removed materials and place same in containers.

## SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

### 3.11 CONSTRUCTION FENCING

- A. Construction fencing and barriers shall be provided by the **General Contractor**, enclosing all work and storage areas as outlined in staging plan at the end of this section and specified within. Temporary construction fencing shall be of good quality and neat in appearance; 8' high chain link fencing, 9 ga fabric on stanchions with vision barrier screening fabric securely fastened. (Post driven installation where approved by CM) Open-Mesh Chain Link Fencing: Provide 0.120-inch-thick, galvanized steel posts, and 2.875" dia. Gate posts. Provide lockable gates. (Keys to owner, architect and CM)
- B. Site access gates shall be provided as required, complete with all operating hardware and security devices.
- C. Should fencing be required to be relocated or modified during the course of the project due to additional access needed by the contractor, same shall be done at the total expense of the contractor.
- D. **The General Work Contractor shall provide a 200' x 200' temporary fence area with 2 ea 10' wheeled gates where directed by the CM. All fenced areas to be 6' high 9 ga. Chain link fence on stations.**

### 3.12 JANITORIAL SERVICE/DAILY CLEANUP

- A. Each Contractor shall furnish daily janitorial services for the project and perform any required maintenance of facilities as deemed necessary by the Architect and Construction Manager during the entire life of the contract. If any contractor fails to keep the site safe and broom clean within 4 hours of being notified by CM, either verbally or in writing, the construction manager will have the cleanup work performed by others and the contractors will be back charged accordingly.
  - 1. In addition to the above, the **General Contractor** shall provide a daily sweep and a weekly damp mop of all work areas.

### 3.13 BURNING

- A. Burning will not be permitted.

### 3.14 FIRE PREVENTION CONTROL

- A. Each Contractor shall comply with the safety provisions of the National Fire Protection Association's "National Fire Codes" pertaining to the work and, particularly, in connection with any cutting or welding performed as part of the work.

### 3.15 TEMPORARY FIRE PROTECTION

- A. Each Contractor shall take all possible precautions for the prevention of fires.
  - 1. Where flame cutting torches, blow torches, or welding tools are required to be used, their use shall be as approved by the Construction Manager at the site.
  - 2. When welding tools or torches of any type are in use, have available in the immediate vicinity of the work a fire extinguisher of the dry chemical 20 lbs. Type. The fire extinguisher(s) shall be provided and maintained by the Contractor doing such work.
- B. Fuel for cutting and heating torches shall be gas only and shall be contained in Underwriters laboratory approved containers.

## SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

- C. No volatile liquids shall be used for cleaning agents or as fuels for motorized equipment or tools within a building except with the express approval of the Owner and/or Architect and in accordance with local codes. On-site bulk storage of volatile liquids shall be outside the buildings at locations directed by the Owner, who shall determine the extent of volatile liquid allowed within the building at any given time.
- D. Each Contractor shall comply with the following requirements relating to compressed gas:
  - 1. Where compressed gas of any type is used for any purpose at the site, it shall be contained in cylinders complying with ICC regulations. Gases of different types shall not be stored together except when in use and when such proximity is required.
  - 2. All persons required to handle gas cylinders or to act as temporary firemen (Fire Watchers) shall be able to read, write and understand the English language; they shall also be required by the Contractor to read Part 3 of Pamphlet P-1 "Safe Handling of Compressed Gases" published by the Compressed Gas Association, 500 Fifth Avenue, New York, NY 10036.
- E. Each Contractor shall comply with the following requirements relating to welding and cutting:
  - 1. All cutting and/or welding (electric or gas) must be done only by skilled, certified and licensed personnel.
  - 2. During welding or cutting operations, a contractor's man shall act as a fire watcher. The fire watcher shall have proper eye protection and suitable firefighting equipment including fire extinguisher (bearing current inspection Certificate), protective gloves and any other equipment deemed necessary.
  - 3. Tanks supplying gases for welding or cutting are to be placed in an upright position securely fastened, and close as practical to the operation. Tanks, actives or spares, shall be protected from excess heat and shall not be placed in stairways, hallways or exits. When not in use, protective valve cap shall be screwed on the cylinder.
  - 4. Adequate fire extinguishing equipment shall be maintained at all welding or cutting operations.

### 3.16 VENTILATION AND HUMIDITY CONTROL FOR CONSTRUCTION:

- A. **General Contractor** will provide temporary ventilation as required for protecting the building from any adverse effects of high humidity during abatement and construction activities. Select dehumidification and ventilating equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements and have sufficient quantity of units to produce necessary ambient conditions.
  - 1. Each Contractor shall be responsible for his own temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity.
  - 2. Ventilate enclosed area to dissipate humidity, and to prevent accumulation of dust, fumes, vapors or gases.
  - 3. Provide equipment as necessary for air and fresh exchange for the work area per OSHA standards.
  - 4. If Contractor fails to adequately ventilate the building during the construction, abatement / roofing process, thereby causing humidity and possible mold issues, the owner will hire others to properly address and deduct costs from the Contractor accordingly.



## SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

5. Any contractor whom allows water infiltration to building is responsible for cleanup and commercial dehumidifiers of sufficient size/qty to prevent mold growth. Failure to immediately address (4 hours notice) will result in the owners hiring others and backcharging in order to insure a safe environment.

### 3.17 TEMPORARY ROADS AND PERMANENT PAVED AREAS:

- A. **General Contractor** shall construct and maintain temporary road areas adequate to support loads and to withstand exposure to traffic during construction period.
  1. Temporary roads/ staging areas will consist of one-layer soil separation fabric, 8" of compacted NYS DOT Item 4. Contractor will maintain and field dress with additional material as necessary to prevent ruts and potholes.
  2. Includes access for delivery through staging area to building work areas, and to equipment and storage areas and sheds.
  3. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
  4. Road Cleaning: Maintain roads and walkways in an acceptably clean condition. This includes the removal of debris daily, if required, and/or a minimum of once a week due to all project traffic. Road cleaning equipment to be wet/vacuum type. The General Contractor will clean roads for debris from building-related activities.
  5. Staging Areas:  
Temporary parking by construction personnel shall be allowed only in areas so designated.

### 3.18 DE-WATERING FACILITIES AND DRAINS

- A. Each Prime Contractor is directly responsible for de-watering of their excavations. The responsibility of de-watering of the site as to facilitate the work will be the responsibility of the General Contractor, coordinate with CM.
- B. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.
- C. Remove snow and ice as required to minimize accumulations.

### 3.19 ROOF PROTECTIONS

- A. All Contractors shall provide temporary protection on the roof surface when it is necessary for work to take place on completed sections. (Minimum 2" rigid insulation and plywood)
- B. Upon such notification as required in subparagraph A, the Contractor shall assume responsibility for damages, if any, to the roofing system caused by the work of other trades, except that financial liability for any and all damages rests with the offending trade.

### 3.20 TEMPORARY SITE SAFETY AND DIRECTIONAL SIGNS

- A. The **General Contractor** shall provide signs as required below. Install signs where required or indicated to inform public and persons seeking entrance to project. All signage and posts become the property of the owner at the conclusion of the project.

## SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

- B. Construct signs in accordance with section 619 of the NYS DOT standard specifications (MUTCD overall sign size, letter size, metal signage). Support on breakaway metal posts or attach to fencing; do not attach signs to buildings or permanent construction.
- C. Include relocating temporary site safety and directional signs as many times as required or directed.
- D. For construction traffic control/flow at entrances/exits, as designated by the Owner (2 required) Large sign 4' x4' Orange with Black Letters ("Construction Entrance Only")
- E. For construction parking (2 required)
- F. To direct deliveries (4 required)
- G. Emergency egress only – Construction area (4 required)
- H. Per OSHA standards as necessary
- I. For "No Smoking" safe work site at multiple locations (4 required)
- J. Construction Area – Do Not Enter (10) mount on fence
- K. No Trespassing (10) mount on fence
- L. A premobilization meeting to establish location and quantities of all signage will be held with contractor, Construction Manager, and owner. Prior to the start of any actual work the signage must be reviewed / approved by the Construction Manager.

### 3.21 STORMWATER CONTROL

- A. Plumber will maintain roof drain run-off during relocation of roof storm piping.

### 3.22 BARRICADES, WARNING SIGNS AND LIGHTS:

- A. Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard.
  - 1. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch-(16-mm-) thick exterior plywood.

### 3.23 TEMPORARY ENCLOSURES

- A. Mechanical Contractor will provide temporary watertight enclosures for protection of construction, from exposure, foul weather and safety for any roof related openings. Close openings in roof deck with load bearing wood framed construction, 3/4" plywood and watertight membrane
- B. General Contractor will provide temporary 2" x4" wood framing, 2" polyiso insulation, 1/2" plywood, and cover with 6 mil plastic; at any open exterior window removal, wall removal, door entrance locations, etc. for weather and security protection at the end of each workday.

## SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

- C. Any other temporary enclosures for specific openings for a contractor to perform their work are the responsibility of the contractor creating the opening and shall be installed to protect the building from exterior elements, security issues, odors / noise resulting from construction.

### 3.24 TEMPORARY PARTITIONS and FLOOR PROTECTIONS

- A. **General Contractor** shall erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate work areas from fumes.
  - 1. Construct dustproof, floor to ceiling partitions of not less than 3-5/8" – 20 ga. studs, 2 layers of 6 mil poly sheets inside / outside, sound batt insulation, exterior sheathing 5/8" plywood, interior sheathing 5/8" gypsum taped/painted where owner occupied. Caulk seal joints and perimeter to prevent dust migrations. Equip partitions with dustproof doors and security locks.
  - 2. Cover floor with 2-layer poly and extend up the side 18". Overlap and tape full length joints
  - 3. Floor Protections – Shall be "Ram-Board" **Heavy Duty** with taped joints or equivalent. Finish Flooring (new or existing) will be fully covered by GC. Areas of isolated MEP work will be protected with Ram- Board by the individual prime contractor

### 3.25 AREAS OF SPECIAL PROTECTION:

- A. In the event of an emergency (designated by the sounding of the fire alarm system) all construction activities must immediately cease. Contractor's work force will evacuate themselves from work areas and remain outside of work areas until the "all clear" is given. No work operations will be tolerated during the evacuation of the building or during an emergency

### 3.26 ENVIRONMENTAL PROTECTION:

- A. Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

### 3.27 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Termination and Removal: Unless the Architect/ CM requests that it be maintained longer, remove each temporary facility when the need has ended or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been affected because of interference with the temporary facility. Repair damaged work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  - 1. Materials and facilities that constitute temporary facilities are the Contractors property.
  - 2. At Substantial Completion, clean and renovate permanent facilities used during the construction period including.

END OF SECTION



## SECTION 015110 – SED COMMISSIONER’S REGULATIONS

### Commissioner’s 155.5 Regulations

#### Uniform Safety Standards for School Construction & Maintenance Projects:

1. “The occupied portion of any school building shall always comply with the minimum requirements necessary to maintain a Certificate of Occupancy.”
2. Indication that all school areas to be disturbed during renovation or demolition have been or will be tested for lead and asbestos. Note, the project folder should contain a letter regarding the presence of asbestos.
3. “General Safety and security standards for construction projects.
  - a. All construction materials shall be stored in a safe and secure manner.
  - b. Fences around construction supplies or debris shall be maintained.
  - c. Gates shall always be locked unless a worker is in attendance to prevent unauthorized entry.
  - d. During exterior renovation work, overhead protection shall be provided for any sidewalks or areas immediately beneath the work site or such areas shall be fenced off and provided with warning signs to prevent entry.
  - e. Workers shall be required to wear photo-identification badges at all times for identification and security purposes while working at occupied sites.”
4. “Separation of construction areas from occupied spaces. Construction areas which are under the control of a contractor and therefore not occupied by district staff or students shall be separated from occupied areas. Provisions shall be made to prevent the passage of dust and contaminants into occupied parts of the building. Periodic inspection and repairs of the containment barriers must be made to prevent exposure to dust or contaminants. Gypsum board must be used in exit ways or other areas that require fire rated separation. Heavy duty plastic sheeting may be used only for a vapor, fine dust, or air infiltration barrier, and shall not be used to separate occupied spaces from construction areas.
  - a. A specific stairwell and/or elevator should be assigned for construction worker use during work hours. In general, workers may not use corridors, stairs, or elevators designated for students or school staff.
  - b. Large amounts of debris must be removed by using enclosed chutes or a similar sealed system. There shall be no movement of debris through halls of occupied spaces of the building. No material shall be dropped or thrown outside the walls of the building.
  - c. All occupied parts of the building affected by renovation activity shall be cleaned at the close of each workday. School buildings occupied during a construction project shall maintain required health, safety and educational capabilities at all times that classes are in session.”
5. A plan detailing how exiting required by the applicable building code will be maintained is not applicable for this project.

6. A plan detailing how adequate ventilation will be maintained during construction is not applicable for this project.
7. "Construction and maintenance operations shall not produce noise in excess of 60 dba in occupied spaces or shall be scheduled for times when the building or affected building spaces are not occupied or acoustical abatement measures shall be taken."
8. "The contractor shall be responsible for the control of chemical fumes, gases, and other contaminants produced by welding, gasoline or diesel engines, roofing, paving, painting, etc. to ensure they do not enter occupied portions of the building or air intakes."
9. "The contractor shall be responsible to ensure that activities and materials which result in "off-gassing" of volatile organic compounds such as glues, paints, furniture, carpeting, wall covering, drapery, etc. are scheduled, cured or ventilated in accordance with manufacturers recommendations before a space can be occupied."
10. "Large and small asbestos abatement projects as defined by 12NYCRR56 shall not be performed while the building is occupied." Note, it is our interpretation that the term "building", as referenced in this section, means a wing or major section of the building that can be completely isolated from the rest of the building with sealed noncombustible construction. The isolated portion of the building must contain exits that do not pass through the occupied portion and ventilation systems must be physically separated and sealed at the isolation barrier.

Exterior work such as roofing, flashing, siding, or soffit work may be performed on occupied buildings provided proper variances are in place as required and complete isolation of ventilation systems and at windows is provided. Care must be taken to schedule work so that classes are not disrupted by noise or visual distraction.

11. Surfaces that will be disturbed by reconstruction must have a determination made as to the presence of lead. Projects which disturbed surfaces that contain lead shall have in the specifications a plan prepared by a certified Lead Risk Assessor or Supervisor which details provisions for occupant protection, work site preparation, work methods, cleaning and clearance testing which are in good accordance with the HUD Guidelines.

END OF SECTION 015110

## SECTION 016000 – PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. Related Sections include the following:
  - 1. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.

#### 1.3 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, which is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility.
  - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

## 1.4 SUBMITTALS

- A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
  2. Form: Tabulate information for each product under the following column headings:
    - a. Specification Section number and title.
    - b. Generic name used in the Contract Documents.
    - c. Proprietary name, model number, and similar designations.
    - d. Manufacturer's name and address.
    - e. Supplier's name and address.
    - f. Installer's name and address.
    - g. Projected delivery date or time span of delivery period.
    - h. Identification of items that require early submittal approval for scheduled delivery date.
  3. Initial Submittal: Within thirty (30) days after date of commencement of the Work, submit three (3) copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
    - a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
  4. Completed List: Within sixty (60) days after date of commencement of the Work, submit three (3) copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
  5. Architect's Action: Architect will respond in writing to Contractor within fifteen (15) days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.
- B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Substitution Request Form: Use CSI Form 13.1A.
  2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified material or product cannot be provided.
    - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such



- as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Samples, where applicable or requested.
  - f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
  - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
  - i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
  - j. Cost information, including a proposal of change, if any, in the Contract Sum.
  - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
  - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within ten (10) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
- a. Form of Acceptance: Change Order.
  - b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
- C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect of approval or rejection of proposed comparable product request within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
- a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
  - b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.
- D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

## 1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
  - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
  - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

## 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
  - 1. Store products to allow for inspection and measurement of quantity or counting of units.
  - 2. Store materials in a manner that will not endanger Project structure.
  - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
  - 4. Store cement products and materials on elevated platforms.
  - 5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
  - 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
  - 7. Protect stored products from damage and liquids from freezing.

8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

## 1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
  2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
  1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
  3. Refer to Divisions 02 through 26 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
  1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected," Architect will make selection.

5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

- a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
- b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

## 2.2 PRODUCT SUBSTITUTIONS

- A. Timing: Architect will consider requests for substitution if received within thirty (30) days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
- B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
  - 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  - 2. Requested substitution does not require extensive revisions to the Contract Documents.
  - 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - 4. Substitution request is fully documented and properly submitted.
  - 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
  - 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - 7. Requested substitution is compatible with other portions of the Work.
  - 8. Requested substitution has been coordinated with other portions of the Work.
  - 9. Requested substitution provides specified warranty.
  - 10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

## 2.3 COMPARABLE PRODUCTS

- A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require extensive revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  3. Evidence that proposed product provides specified warranty.
  4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
  5. Samples, if requested.

END OF SECTION 016000

## SECTION 017300 – EXECUTION REQUIREMENTS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. General installation of products.
  - 4. Coordination of Owner-installed products.
  - 5. Progress cleaning.
  - 6. Starting and adjusting.
  - 7. Protection of installed construction.
  - 8. Correction of the Work.
- B. Related Sections include the following:
  - 1. Division 1 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
  - 2. Division 1 Section "Submittal Procedures" for submitting surveys.
  - 3. Division 1 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
  - 4. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
  - 1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
  - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
  - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
    - a. Description of the Work.
    - b. List of detrimental conditions, including substrates.
    - c. List of unacceptable installation tolerances.
    - d. Recommended corrections.
  - 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  - 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.



### 3.02 PREPARATION

- A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

### 3.03 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager promptly.
- B. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- C. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

### 3.04 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
  - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
  - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

- C. Benchmarks: Establish and maintain a minimum of two (2) permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
  - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

### 3.05 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
  - 4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.

3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.06 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
  1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.07 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

### 3.08 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

### 3.09 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

## SECTION 017419 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
  - 1. Disposing of nonhazardous demolition and construction waste.

#### 1.02 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

#### 1.03 SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three (3) copies of report. Include separate reports for demolition and construction waste. Include the following information:
  - 1. Material category.
  - 2. Generation point of waste.
  - 3. Total quantity of waste in tons.
  - 4. Quantity of waste salvaged, both estimated and actual in tons.
  - 5. Quantity of waste recycled, both estimated and actual in tons.
  - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.

7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit three (3) copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

#### 1.04 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Waste Management Conference: Conduct conference at Project site.

#### 1.05 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification and waste reduction work plan.[ Include separate sections in plan for demolition and construction waste.] Indicate quantities by weight or volume but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
  1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.

2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

D. Forms: Prepare waste management plan on forms included at end of Part 3.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.01 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by Architect and Construction Manager. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
  1. Distribute waste management plan to everyone concerned within five (5) days of submittal return.
  2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.

### 3.02 SALVAGING DEMOLITION WASTE

#### A. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

#### B. Salvaged Items for Sale and Donation: Not permitted on Project site.

#### C. Salvaged Items for Owner's Use:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Protect items from damage during transport and storage.

### 3.03 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

#### A. General: Recycle paper and beverage containers used by on-site workers.

#### B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

#### C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
  - a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.



3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

### 3.04 RECYCLING DEMOLITION WASTE

- A. Asphaltic Concrete Paving: Grind asphalt to maximum 1-1/2-inch size.
- B. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.
- C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
  1. Pulverize concrete to maximum 1-1/2-inch size.
- D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
  1. Pulverize masonry to maximum 3/4-inch size.
  2. Clean and stack undamaged, whole masonry units on wood pallets.
- E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- F. Metals: Separate metals by type.
  1. Structural Steel: Stack members according to size, type of member, and length.
  2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- H. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
  1. Separate suspension system, trim, and other metals from panels and tile and sort with other metals.
- J. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
  1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

- K. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- L. Plumbing Fixtures: Separate by type and size.
- M. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- N. Lighting Fixtures: Separate lamps by type and protect from breakage.
- O. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.
- P. Conduit: Reduce conduit to straight lengths and store by type and size.

### 3.05 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
  - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 2. Polystyrene Packaging: Separate and bag materials.
  - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees at landfill facility.
- C. Wood Materials:
  - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.
  - 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

### 3.06 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.

- 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.
- D. Disposal: Transport waste materials and dispose of at designated spoil areas on Owner's property.
- E. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 017419



## SECTION 01 74 23 – CLEANING UP

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION OF THE WORK:**

**A.** The work of this section relates to the following:

1. Maintain all premises and public properties/roadways free from accumulations of waste, debris, dirt, mud and rubbish caused by operations on a daily basis.
2. At completion of work, remove waste materials, rubbish tools, equipment, machinery and surplus materials, and clean all sight exposed surfaces; leave project clean and ready for occupancy.
3. Remove any overspray caused by construction operations from adjacent construction, surfaces.

**B.** Related Requirements Specified Elsewhere

1. Summary of work: Section 011000
2. Cleaning for Specific Products or Work: the respective sections of the specifications:

#### **1.2 SAFETY REQUIREMENTS**

**A.** Standards: Maintain project in accord with safety and insurance standards.

**B.** Hazard Control/Cleaning Products

1. Store volatile waste in covered metal containers and remove from premises daily.
2. Provide adequate ventilation during use of volatile or noxious substances.

**C.** Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on project site.
2. Do not dispose of volatile waste such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
3. Do not dispose of waste into streams or waterways.

### **PART 2 - PRODUCTS**

#### **2.1 Materials:** Use only cleaning materials recommended by manufacturer of surface to be cleaned.

### **PART 3 - EXECUTION**

#### **3.1 REQUIREMENTS DURING CONSTRUCTION:**

**A.** Execute daily cleaning to ensure that building, grounds, and public properties and roadways are maintained free from accumulations of waste materials, rubbish, dirt, mud and dust.

**B.** Wet down dry materials and rubbish to lay dust and prevent blowing dust.

**C.** Each day, all contractors shall adhere to the following:

## SECTION 01 74 23 – CLEANING UP

1. Areas of intense activity, such as cutting and sawing must be swept clean and reorganized at the end of each day. Utilize dust control methods such as plastic containment, containment hut and/or wetting of surfaces.
2. Areas of moderate activity such as installation of plumbing, ductwork, electrical work must be returned to good order at the end of each day.
3. Debris below scaffolds (and shoring/re-shoring) must at all time, be kept sufficiently consolidated to keep walkways free of tripping hazards. These work areas must also be swept clean immediately upon removal of scaffolds.
4. All swept up debris, waste materials, and packing must be removed and placed in the dumpster by the end of the workday.
5. All stored material must be protected and kept in good order.
6. As portions of the work are completed, all used and excess materials must be removed promptly.
7. Daily Clean-up and good housekeeping is the responsibility of each contractor individually and will be monitored by the Construction Manager. If any contractor fails to perform cleaning when directed or does not properly clean within 4 hours of being notified by Construction Manager, the owner will hire others and charge contractor(s) accordingly.
8. Contractors shall promptly comply with requests to organize scattered materials.

- D. **Each Contractor** is responsible for furnishing all dumpsters or other such containers as required for collection, storage and legal disposal of all debris and rubbish resultant from their construction operations. The Construction Manager shall locate and request to move such containers as necessary and legally dispose of waste as containers are filled. Separate and recycle as required authorities and regulations.
- E. Vacuum clean areas when ready to receive finish painting, and continue vacuum cleaning on an as needed basis until building is ready for Substantial Completion or occupancy.
- F. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.
- G. Schedule cleaning operations so that dust and other containment resulting from cleaning process will not fall on wet, newly painted surfaces.

### 3.2 FINAL CLEANING

- A. Each Contractor Shall:
1. Employ professional cleaners for final cleaning.
  2. In preparation for substantial completion or occupancy, conduct final inspection of sight exposed interior and exterior surfaces, and of concealed spaces.
  3. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surface so designated to shine finish.
  4. Maintain cleaning until project, or portion thereof, is occupied by owner.
  5. Repair, patch and touch up marred surfaces to specified finish, to match adjacent surfaces.

## SECTION 01 74 23 – CLEANING UP

6. If the contractor fails to perform final cleaning when directed or does not properly clean within 4 hours of being notified by Construction Manager, the owner will hire others and charge contractor accordingly.
- B. **General Contractor**: shall complete the following restoration operations before requesting inspection for certification of Substantial Completion for entire Project or portion of Project:
1. Restoration of any lawn and walk/curb areas disturbed by construction operations. This includes repairs of any ruts / damage created by Heavy equipment, Lulls, cranes, etc.
  2. Magnet sweeping of all exterior lawn areas to ensure that no stray nails / screws, etc. remain in lawn areas.
  3. Hire professional cleaning company (not construction tradesmen) to thoroughly clean all surfaces, including glass, floors, doors, windows, etc.
  4. Final Clean Gym & floors using the exact same products / coats as the owner's custodial staff for compatibility purposes. Vacuum any carpet areas
  5. Power sweep all asphalt areas using a commercial street sweeper (water method)
  6. Remove any stickers, protective coverings, etc.
  7. Clean all gym equipment, etc..
- C. **Mechanical Contractor**: shall complete the following cleaning operations before requesting final inspection for certification of Substantial Completion for entire project or portion of project.
1. Clean all Mechanical units, including removal of any stickers, protective covering. Wipe down of all unit surfaces for clean streak free surfaces
  2. Vacuum out all ductwork, grills / louvers to insure there is no construction debris or dust
  3. Replace all air filters at no additional cost immediately prior to owner occupancy
  4. Restoration of any lawn and walk/curb areas disturbed by construction operations. This includes repairs of any ruts / damage created by Heavy equipment, Lulls, cranes, etc.
- D. **Electrical Contractor**: shall complete the following cleaning operations before requesting final inspection for certification of Substantial Completion for entire project or portion of project.
1. Clean surfaces of all electrical equipment from any dust. Remove any labels or protective films
  2. Replace any burned out or non-functioning bulbs
- E. **Plumbing Contractor**: shall complete the following cleaning operations before requesting final inspection for certification of Substantial Completion for entire project or portion of project.
1. Clean surfaces of all plumbing fixtures & equipment from any dust or dirt.
  2. Remove any labels or protective films

SECTION 01 74 23 – CLEANING UP

3.3 RUBBISH REMOVAL

- A. Contractors shall comply with all Local, State and Federal Laws, Codes and Requirements regarding recycling and trash or rubbish removal.

END OF SECTION 017423



## SECTION 017700 – CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.
- B. Refer to Article 15 of the General Conditions for additional requirements.

#### 1.02 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 "Photographic Documentation" for submitting Final Completion construction photographs and negatives.
  - 2. Divisions 1 Section "Selective Demolition".

#### 1.03 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. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 3. 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.
  - 4. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
  - 5. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.

6. Complete final cleaning requirements, including touchup painting.
  7. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor 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.

#### 1.04 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.
  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. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.05 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
2. 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.

## 1.06 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 Final Completion is indicated.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
  1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (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

### 2.01 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

### 3.01 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 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. 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.
    - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - g. Remove labels that are not permanent.
    - h. 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.
- C. 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 017700

## SECTION 01 77 01 – CLOSEOUT CHECKLIST

### PART 1 – GENERAL

#### 1.1 SUBMITTALS

- a. Submit the following documents to the Architect/Engineer before Substantial Completion:
  - ☐ Project Record Documents as specified in Section 017839.
  - ☐ Operations and Maintenance Manuals prepared in accordance with Section 017823 and be updated as a result of start-up activities.
  - ☐ Manufacturer's Start-up Reports (MSR's) for all equipment and systems where manufacturer field time is specified.
    - a. Each MSR shall be signed by the field technician(s) who attended the start-up.
    - b. If the manufacturer is taking exception to the installation or if the warranty is voided, he shall provide a statement to that effect and provide reasons and justification to explain the company's position.
  - ☐ One binder containing original counterparts of all warranties, guarantees, bonds, or affidavits as specified in the Technical Specification Sections. These documents shall contain the original signatures and be placed in a plastic sheet protector, one document per protector.
  - ☐ Spare parts checklist itemizing all spare parts furnished under the Contract summarized by Section.
  - ☐ Electrical Underwriter's Certificate where the prime construction contract includes electrical construction or where this Contract is for a Prime Electrical Construction Contract.
- b. Submit the following items to the Architect/Engineer with the final application for payment:
  - ☐ Final Application for Payment and continuation (G702 and G732)
  - ☐ Contractor's Certified Payrolls
  - ☐ OSHA cards for all workers
  - ☐ Contractor's Affidavit of Payment of Debts and Claims (G706)
  - ☐ Contractor's Affidavit of Release of Liens (G706A)
  - ☐ Final list of Subcontractors (G705)
  - ☐ Subcontractor's Affidavit of Payment of Debts and Claims (G706) – (for each subcontractor used)
  - ☐ Subcontractor's Affidavit of Release of Liens (G706A) – (for each subcontractor used)
  - ☐ Consent of Surety to Final Payment (G707)
  - ☐ 2 Year Maintenance Bond – 100% of contract including change orders
  - ☐ Contractors letter guaranteeing workmanship 2 years
  - ☐ Product data, Maintenance manuals and Warranty information
  - ☐ As Built Documentation – 1 Electronic Copy & 1 Full-size Copy
  - ☐ Attic Stock/Spare Parts (provide proof of delivery transmittal signed by owner)
  - ☐ Training and Demonstrations (provide sign-in from training session and electronic copy)
  - ☐ Asbestos Affidavit and waste manifests
- c. All documents shall be complete, signed, dated, and notarized (where applicable) and be subject to the Architect/Engineer's acknowledgment of receipt or approval.

**Retainage reduction will not be considered until all items indicated on the above checklist are received in accordance with Section 017700 – Closeout Procedures.**

**END OF SECTION 017701**



## SECTION 017823 – OPERATION AND MAINTENANCE DATA

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Emergency manuals.
  - 3. Operation manuals for systems, subsystems, and equipment.
  - 4. Product maintenance manuals.
  - 5. Systems and equipment maintenance manuals.

#### 1.02 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
  - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
    - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    - b. Enable inserted reviewer comments on draft submittals.
  - 2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.
- C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
  - 1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of

receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

## PART 2 - PRODUCTS

### 2.01 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.
- B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  - 1. Title page.
  - 2. Table of contents.
  - 3. Manual contents.
- C. Title Page: Include the following information:
  - 1. Subject matter included in manual.
  - 2. Name and address of Project.
  - 3. Name and address of Owner.
  - 4. Date of submittal.
  - 5. Name and contact information for Contractor.
  - 6. Name and contact information for Construction Manager.
  - 7. Name and contact information for Architect.
  - 8. Name and contact information for Commissioning Authority.
  - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
  - 10. Cross-reference to related systems in other operation and maintenance manuals.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.



- F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
  2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
  3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
  4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## 2.02 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
  2. Emergency instructions.
  3. Emergency procedures.

- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
  2. Flood.
  3. Gas leak.
  4. Water leak.
  5. Power failure.
  6. Water outage.
  7. System, subsystem, or equipment failure.
  8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
  2. Shutdown instructions for each type of emergency.
  3. Operating instructions for conditions outside normal operating limits.
  4. Required sequences for electric or electronic systems.
  5. Special operating instructions and procedures.

## 2.03 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  2. Performance and design criteria if Contractor is delegated design responsibility.
  3. Operating standards.
  4. Operating procedures.
  5. Operating logs.
  6. Wiring diagrams.

7. Control diagrams.
  8. Piped system diagrams.
  9. Precautions against improper use.
  10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
  2. Manufacturer's name.
  3. Equipment identification with serial number of each component.
  4. Equipment function.
  5. Operating characteristics.
  6. Limiting conditions.
  7. Performance curves.
  8. Engineering data and tests.
  9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
  2. Equipment or system break-in procedures.
  3. Routine and normal operating instructions.
  4. Regulation and control procedures.
  5. Instructions on stopping.
  6. Normal shutdown instructions.
  7. Seasonal and weekend operating instructions.
  8. Required sequences for electric or electronic systems.
  9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

## 2.04 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
  - 1. Product name and model number.
  - 2. Manufacturer's name.
  - 3. Color, pattern, and texture.
  - 4. Material and chemical composition.
  - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
  - 1. Inspection procedures.
  - 2. Types of cleaning agents to be used and methods of cleaning.
  - 3. List of cleaning agents and methods of cleaning detrimental to product.
  - 4. Schedule for routine cleaning and maintenance.
  - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

## 2.05 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
  - 1. Standard maintenance instructions and bulletins.
  - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  - 3. Identification and nomenclature of parts and components.
  - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
  - 1. Test and inspection instructions.
  - 2. Troubleshooting guide.
  - 3. Precautions against improper maintenance.
  - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - 5. Aligning, adjusting, and checking instructions.
  - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

## PART 3 - EXECUTION

### 3.01 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original project record documents as part of operation and maintenance manuals.
- F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

## SECTION 017839 – PROJECT RECORD DOCUMENTS

### PART 1 - GENERAL

#### 1.01 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.

#### 1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
- B. Related Sections include the following:
  - 1. Division 1 Section "Closeout Procedures" for general closeout procedures.
  - 2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 3. Divisions 1 Section "Selective Demolition".

#### 1.03 SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit one (1) set(s) of marked-up Record Prints.
  - 2. Number of Copies: Submit copies of Record Drawings as follows:
    - a. Final Submittal: Submit one (1) set(s) of marked-up Record Prints, one (1) set(s) of Record Transparencies, and four (4) copies printed from Record Transparencies. Print each Drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one copy (1) of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit five (5) copies of each Product Data submittal.
  - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

## PART 2 - PRODUCTS

### 2.01 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
  - 1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an understandable drawing technique.
    - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
  - 2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations below first floor.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Duct size and routing.
    - i. Locations of concealed internal utilities.
    - j. Changes made by Change Order or Construction Change Directive.
    - k. Changes made following Architect's written orders.
    - l. Details not on the original Contract Drawings.
    - m. Field records for variable and concealed conditions.
    - n. Record information on the Work that is shown only schematically.
  - 3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
  - 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  - 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  - 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Transparencies: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect. When authorized, prepare a full set of corrected transparencies of the Contract Drawings and Shop Drawings.



1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.
  2. Refer instances of uncertainty to Architect for resolution.
  3. Owner will furnish Contractor one set of transparencies of the Contract Drawings for use in recording information.
  4. Print the Contract Drawings and Shop Drawings for use as Record Transparencies. Architect will make the Contract Drawings available to Contractor's print shop.
- C. Record CAD Drawings: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect. When authorized, prepare a full set of corrected CAD Drawings of the Contract Drawings, as follows:
1. Format: Same CAD program, version, and operating system as the original Contract Drawings.
  2. Format: DWG Version, operating in Microsoft Windows operating system.
  3. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.
  4. Refer instances of uncertainty to Architect for resolution.
  5. Architect will furnish Contractor one set of CAD Drawings of the Contract Drawings for use in recording information.
    - a. Architect makes no representations as to the accuracy or completeness of CAD Drawings as they relate to the Contract Drawings.
- D. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
  2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- E. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.

3. Record CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each CAD file.
4. Identification: As follows:
  - a. Project name.
  - b. Date.
  - c. Designation "PROJECT RECORD DRAWINGS."
  - d. Name of Architect.
  - e. Name of Contractor.

## 2.02 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
  1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
  5. Note related Change Orders and Record Drawings where applicable.

## 2.03 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  3. Note related Change Orders and Record Drawings where applicable.

## 2.04 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

## PART 3 - EXECUTION

### 3.01 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's and DPMC Representative reference during normal working hours.

END OF SECTION 017839



## SECTION 019113 – GENERAL COMMISSIONING REQUIREMENTS

### 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.
- B. OPR and BoD documentation prepared by Owner and Architect contains requirements that apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.
- B. Related Sections include the following:
  - 1. Division 23 for specific requirements for commissioning HVAC systems.

#### 1.3 DEFINITIONS

- A. BoD: Basis of Design.
- B. CxA: Commissioning Authority.
- C. OPR: Owner's Project Requirements.
- D. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.
- E. TAB: Testing, Adjusting, and Balancing.

#### 1.4 COMMISSIONING TEAM

- A. Members Appointed by Contractor(s): Individuals, each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of each Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the Engineer/Architect/Project Management Firm.
- B. Members Appointed by Owner:
  - 1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. In this project, Architect/Engineer/Project Management Firm will oversee the commissioning process.
  - 2. Representatives of the facility user and operation and maintenance personnel.

3. Architect and engineering design professionals.

## 1.5 OWNER'S RESPONSIBILITIES

- A. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:
  1. Coordination meetings.
  2. Training in operation and maintenance of systems, subsystems, and equipment.
  3. Testing meetings.
  4. Demonstration of operation of systems, subsystems, and equipment.
- B. Provide utility services required for the commissioning process.
- C. Provide the BoD documents, prepared by Architect and approved by Owner, to each Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

## 1.6 CONTRACTOR'S RESPONSIBILITIES

- A. Provide utility services required for the commissioning process.
- B. Each Contractor shall assign representatives with expertise and authority to act on behalf of the Contractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
  1. Participate in construction-phase coordination meetings.
  2. Participate in maintenance orientation and inspection.
  3. Participate in operation and maintenance training sessions.
  4. Participate in final review at acceptance meeting.
  5. Certify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
  6. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
  7. Review and approve final commissioning documentation.
- C. Subcontractors shall assign representatives with expertise and authority to act on behalf of subcontractors and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
  1. Participate in construction-phase coordination meetings.
  2. Participate in maintenance orientation and inspection.
  3. Participate in procedures meeting for testing.
  4. Participate in final review at acceptance meeting.

5. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to Architect/Engineer/Project Management Firm for incorporation into the commissioning plan. Update schedule on a weekly basis (or as agreed) throughout the construction period.
6. Provide information to the Architect/Engineer/Project Management Firm for developing construction-phase commissioning plan.
7. Participate in training sessions for Owner's operation and maintenance personnel.
8. Gather and submit operation and maintenance data for systems, subsystems, and equipment to the Architect/Engineer/Project Management Firm, as specified in Division 1 Section "Operation and Maintenance Data."
9. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures and participate in testing of installed systems, subsystems, and equipment.

#### 1.7 ARCHITECT/ENGINEER/PROJECT MANAGEMENT FIRM RESPONSIBILITIES

- A. Organize and lead the commissioning team.
- B. Review and comment on submittals from each Contractor for compliance with the OPR, BoD, Contract Documents, and construction-phase commissioning plan. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the OPR and BoD.
- C. At the beginning of the construction phase, conduct an initial construction-phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; and Project completion.
- D. Observe and inspect construction and report progress and deficiencies. In addition to compliance with the OPR, BoD, and Contract Documents, inspect systems and equipment installation for adequate accessibility for maintenance and component replacement or repair.
- E. Prepare Project-specific test and inspection procedures and checklists.
- F. Schedule, direct, witness, and document tests, inspections, and systems startup.
- G. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.
- H. Certify date of acceptance and startup for each item of equipment for start of warranty periods.
- I. Review Project Record Documents for accuracy. Request revisions from Contractor to achieve accuracy. Project Record Documents requirements are specified in Division 1 Section "Project Record Documents."
- J. Review and comment on operation and maintenance documentation and systems manual outline for compliance with the OPR, BoD, and Contract Documents. Operation and maintenance documentation requirements are specified in Division 1 Section "Operation and Maintenance Data."

- K. Prepare operation and maintenance training program. Operation and maintenance training is specified in Division 23.

## 1.8 QUALITY ASSURANCE

- A. Instructor Qualifications: Factory-authorized service representatives, experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.
- B. Test Equipment Calibration: Comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

- A. Training Preparation Conference: Before operation and maintenance training, Architect/Engineer/Project Management Firm shall convene a training preparation conference to include Owner's operation and maintenance personnel, Contractor, and subcontractors. In addition to requirements specified in Division 23 perform the following:
  - 1. Review the BoD.
  - 2. Review installed systems, subsystems, and equipment.
  - 3. Review instructor qualifications.
  - 4. Review instructional methods and procedures.
  - 5. Review training module outlines and contents.
  - 6. Review course materials (including operation and maintenance manuals).
  - 7. Inspect and discuss locations and other facilities required for instruction.
  - 8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
  - 9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.
- B. Training Modules: Develop an instruction program that includes individual training modules for each system, subsystem, and equipment as specified in Division 23.

END OF SECTION 019113



## SECTION 033000 – CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Formwork for cast-in-place concrete with shoring and bracing
2. Formwork accessories
3. Form stripping
4. Reinforcing steel for cast-in-place concrete
5. Cast-in-place concrete including the following:
  - a. Foundations and footings
  - b. Foundation walls
  - c. Floor slabs
  - d. Retaining Walls
  - e. Equipment pads and bases
  - f. Steel pan stairs
  - g. Exterior stairs
6. Concrete curing.

##### B. Related Sections:

#### 1.2 REFERENCES

##### A. General:

1. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the work. Where differences exist between codes and standards, the one affording the greatest protection shall apply.

##### B. American Concrete Institute (ACI):

- |    |           |  |
|----|-----------|--|
| 1. | ACI 117   | Specification for Tolerances for Concrete Construction |
| 2. | ACI 211.1 | Proportioning Concrete Mixtures                        |
| 3. | ACI 301   | Specifications for Structural Concrete                 |
| 4. | ACI 303.1 | Specification for Cast-in-Place Architectural Concrete |
| 5. | ACI 305   | Hot Weather Concreting                                 |
| 6. | ACI 306   | Specifications for Cold Weather Concreting             |
| 7. | ACI 308   | Specifications for Curing Concrete                     |
| 8. | ACI 309   | Consolidation of Concrete                              |
| 9. | ACI 318   | Building Code Requirements for Structural Concrete     |

#### 1.3 SUBMITTALS

- A. Product Data: Provide data for proprietary materials, including admixtures curing materials, and finish materials.
- B. Submit Placement Shop Drawings, showing location of construction joints. Clearly indicate the construction joints in different locations than those shown in the drawings.
- C. Samples: As requested by testing laboratory.
- D. Mix design for each concrete mix.

- E. Include compression test data used to establish mix proportions.
- F. Submit certification that the facilities of the ready-mix plant comply with the requirements of ASTM C94.
- G. Material Certificates.
  - 1. Cementitious materials, including supplemental cementitious material.
  - 2. Aggregates, including gradation and combined gradation.
  - 3. Admixtures. Where more than one admixture is proposed, include statement from admixture manufacturer indicating that admixtures proposed for use are compatible, such that desirable effects of each admixture will be realized.
- H. Submit ticket to Testing Laboratory for each batch of concrete delivered.
  - 1. Mix identification.
  - 2. Weights of cementitious materials, aggregates, water and admixtures, and aggregate size.

#### 1.4 QUALITY ASSURANCE

- A. Standards: Comply with provisions of ACI 301, except where more stringent requirements are indicated. Evaluation and acceptance of concrete structures will be in accordance with ACI 301.
- B. Concrete Mix Design: Submit proposed mix designs and test data before concrete operations begin. Identify for each mix submitted the method by which proportions have been selected. Each mix shall be identified as it will appear on batch tickets delivered to project site.
  - 1. For mix designs based on field experience, include individual strength test results, standard deviation, and required average compressive strength calculations.
  - 2. For mix designs based on trial mixtures, include trial mix proportions, test results, and graphical analysis and show required average compressive strength.
  - 3. Indicate quantity of each ingredient per cubic yard of concrete.
  - 4. Indicate type and quantity of admixtures proposed or required.
- C. Certificates of Compliance: Acceptability of the following materials will be based upon documentation furnished by the manufacturer identifying each batch of material and certifying compliance with the requirements specified:
  - 1. Portland cement.
  - 2. Fly ash.
  - 3. Chemical admixtures.
- D. Certified Laboratory Test Reports: Before delivery of materials submit certified copies of the reports of the tests required in referenced standards or otherwise specified here. The testing shall have been performed by an independent laboratory within one year of submittal of test reports for approval. Test reports on a previously tested material shall be accompanied by certificates from the manufacturer certifying that the previously tested material is of the same type, quality, manufacture and make as that proposed for use in the project. Certified test reports are required for the following:
  - 1. Portland Cement.

2. Aggregates.
3. Admixtures.

E. Survey anchor bolts for placement and alignment prior to casting concrete.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver reinforcement to project site bundled and tagged with metal tags, indicating bar size, lengths, and other data corresponding to information shown on placement drawings.
- B. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or rust.
- C. Store cementitious materials in a dry, weathertight location. Maintain accurate records of shipment and use.
- D. Store aggregates to permit free drainage and to avoid contamination with deleterious matter or other aggregates. When stockpiled on ground, discard bottom 6 inches of pile.

#### 1.6 PROJECT CONDITIONS

- A. Cold-Weather Concreting: Comply fully with the recommendations of ACI 306.
  1. Well in advance of proposed concreting operations, advise the engineer of planned protective measures including but not limited to heating of materials, heated enclosures, and insulating blankets.
- B. Hot-Weather Concreting: Comply fully with the recommendations of ACI 305.
  1. Well in advance of proposed concreting operations, advise the engineer of planned protective measures including but not limited to cooling of materials before or during mixing, placement during evening to dawn hours, fogging during finishing and curing, shading, and windbreaks.

### PART 2 - PRODUCTS

#### 2.1 FORMWORK

- A. Facing Materials:
  1. Unexposed finish concrete: Any standard form materials that produce structurally sound concrete.
  2. Exposed finish concrete: Materials selected to offer optimum smooth, stain-free final appearance and minimum number of joints. Provide materials with sufficient strength to resist hydrostatic head without bow or deflection in excess of allowable tolerances.
- B. Formwork Accessories:
  1. Foam coating: Foam release agent that will not adversely affect concrete surfaces or prevent subsequent application of concrete coatings.
  2. Metal ties: Commercially manufactured types; cone snap ties, taper removable bolt, or other type which will leave no metal closer than 1-1/2 inches from surface of concrete when forms are removed, leaving not more than a 1-inch-diameter hole in concrete surface.

3. Fillets: Wood or plastic fillets for chamfered corners, in maximum lengths possible.

## 2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: Provide deformed bars complying with ASTM A615, Grade 60, except where otherwise indicated.
- B. Reinforcing Bar Mats: ASTM A184.
- C. Welded Wire Fabric: ASTM A1064, cold-drawn steel, plain.
- D. Reinforcing Accessories:
  1. Tie wire: Black annealed type, 16-1/2 gage or heavier.
  2. Supports: Bar supports conforming to specifications of CRSI "Manual of Standard Practice."
    - a. Class 1 (plastic protected) where legs of wire bar supports contact forms.
    - b. Precast concrete blocks of strength equal to or greater than specified strength of concrete or Class 3 supports equipped with sand plates, where concrete will be cast against earth. Concrete masonry units will not be accepted.

## 2.3 CONCRETE MATERIALS

- A. Cementitious materials and aggregates for exposed concrete shall be from same source throughout the work.
- B. Cementitious Material: An intimate blend of Portland cement and supplemental cementitious material. Cementitious material shall include a maximum of 15 percent fly ash or ground blast furnace slag by weight unless the strength is specified to be achieved in 7 or 14 days. Cementitious material shall comply with ACI 318 Chapter 4 requirements for exposure class S1.
- C. Portland Cement: ASTM C150 and as follows:
  1. Type I except where other type is specifically permitted or required.
    - a. Type I can be replaced by Type III (high early strength) for concrete placed during cold weather.
- D. Supplemental Cementitious Materials:
  1. Fly Ash: ASTM C618, Class F with the following Modified ASTM requirements:
    - a. Loss of Ignition (L.O.I.): maximum 1 percent.
    - b. Sulfur Trioxide (SO<sub>3</sub>) shall not exceed 3 percent by weight.
  2. Ground Blast Furnace Slag: ASTM C989.
- E. Aggregates
  1. Normal weight concrete: ASTM C33.
    - a. Class S3
  2. Light weight concrete: ASTM C330.
  3. Maximum size of coarse aggregate, whichever is least:
    - a. One-fifth narrowest dimension between sides of forms.
    - b. Three-fourths of minimum clear distance between reinforcing bars or between bars and side of form.

- c. Columns and piers: Two-thirds of minimum clear distance between bars.
- F. Water: Mixing water shall be clean, potable and free from deleterious material.
- G. Admixtures - General
  - 1. Admixtures containing more than 0.1 percent chloride ions are not permitted.
  - 2. Where mix contains more than one admixture, all admixtures shall be supplied by one manufacturer. Manufacturer shall certify that admixtures are compatible such that desirable effects of each admixture will be realized.
  - 3. Liquid admixtures shall be considered part of the total water.
- H. Water Reducing Admixture: ASTM C494, Type A. Provide in all concrete at necessary dosage to facilitate placement.
- I. Mid to High Range Water Reducing Admixture: ASTM C494, Type F; polycarboxylate formulation. Provide in mid-range or high-range dosage as necessary for placement at the maximum water to cement ratio specified.
- J. Set Accelerating Admixture: ASTM C494, Type E, non-chloride. Subject to approval of engineer, provide in necessary dosage to accelerate set.
- K. Set Retarding Admixture: ASTM C494, Type D. Subject to approval of engineer, provide in necessary dosage to retard set.
- L. Fibrous Reinforcement: Polypropylene fibers designed and engineered specifically for secondary reinforcement of concrete.
- M. All concrete slabs to receive Vaporlok 20/20 by SPG, or approved equal, to prevent any slab moisture issues which negatively impact floor finish installation.

## 2.4 ACCESSORIES

- A. Curing Compounds: ASTM C309, Type 1 which will not discolor concrete or affect bonding of other finishes applied, and which restricts loss of water to not more than 0.500 grams per square centimeter of surface when tested per ASTM C156, "Test Method for Water Retention by Concrete Curing Materials."
- B. Bonding Compound: Non-redispersible acrylic bonding admixture, ASTM C1059, Type II.
- C. Slab Curing Membrane: Membrane conforming to ASTM C171, non-staining.
- D. Burlap Sheet: AASHTO M182, class 3 or 4.
- E. Vapor Barrier: ASTM D2103, "Polyethylene Film and Sheeting."
- F. Grout: ASTM C1107, Grade B non-shrink, non-metallic, prepackaged grout.
- G. Waterstops: Provide waterstops at construction joints and as otherwise indicated, sized and configured to suit joints.
- H. Expansion Joint Filler: Nonextruding bituminous type: ASTM D1751.

## 2.5 CONCRETE MIXES

- A. Proportioning of Concrete: Comply with recommendations of ACI 211.1.

- B. Required Average Strength: Establish the required average strength of the design mix on the basis of either field experience or trial mixtures as specified in ACI 301, and proportion mixes accordingly. If trial mixture method is used, employ an independent testing agency acceptable to the engineer for preparing and reporting proposed mix design.
- C. Specified compressive strength  $f'(c)$  at 28 days:
1. Foundations and footings: 4000 psi
  2. Walls, columns, suspended slabs, and beams: 4000 psi
  3. Floor slabs on grade: 4000 psi
  4. Concrete fill on metal deck: 4000 psi
  5. Miscellaneous curbs and pads: 4500 psi (per detail CD.01)
- D. Slump: The concrete mix design shall provide for a concrete slump appropriate to the project conditions. The concrete shall be sufficiently fluid to allow for ease of placement and sufficiently stiff to prevent segregation.
- E. Fibrous Reinforcement: Where specified or approved, add to mix at rate recommended by manufacturer for specific application.
1. Add to concrete mix in lieu of providing welded wire fabric reinforcement for interior floor slabs, at contractor's option and with prior approval of engineer.
- F. Water to Cementitious Material Ratio: Water-to-cementitious-material ratio shall not exceed 0.45 by weight. Weight of water shall include all free moisture, including liquid admixtures.
- G. Air-entraining admixture: Use in mixes for exterior exposed concrete unless otherwise specifically indicated. Add at rate to achieve total air content of 6 percent. For concrete not exposed to exterior, add at rate to achieve total air content between 2 percent and 4 percent.
- H. Water-reducing admixture: Add as required for placement and workability.
- I. Water-reducing and retarding admixture: Add as required in concrete mixes to be placed at ambient temperatures above 90 degrees F.
- J. Water-reducing and accelerating admixture: Add as required in concrete mixes to be placed at ambient temperatures below 50 degrees F.
- K. High-range water-reducing admixture (superplasticizer): As required for placement and workability.
- L. Mix Adjustments: Provided that no additional expense to owner is involved, contractor may submit for approval requirements for adjustment to approved concrete mixes when circumstances such as changed project conditions, weather, or unfavorable test results occur. Include laboratory test data substantiating specified properties with mix adjustment requests.

## 2.6 CONTROL OF MIX IN THE FIELD

- A. Slump: A tolerance of up to 1 inch above approved design mix slump will be permitted for 1 batch in 5 consecutive batches tested. Concrete of lower slump than that specified may be used, provided proper placing and consolidation is obtained.
- B. Total Air Content: A tolerance of plus or minus 1 percent of approved design mix air content will be allowed for field measurements.
- C. Do not use batches that exceed tolerances.

## PART 3- EXECUTION

### 3.1 FORMWORK ERECTION

- A. General: Comply with requirements of ACI 301 for formwork, and as herein specified. The contractor is responsible for design, engineering, and construction of formwork, and for its timely removal.
- B. Earth forms: Hand trim sides and bottom of earth forms; remove loose dirt.
- C. Design: Design and fabricate forms for easy removal, without impact, shock, or damage to concrete surfaces or other portions of the work. Design to support all applied loads until concrete is adequately cured, within allowable tolerances and deflection limits.
- D. Construction: Construct and brace formwork to accurately achieve end results required by contract documents, with all elements properly located and free of distortion. Provide for necessary openings, inserts, anchorages, and other features shown or otherwise required.
  - 1. Joints: Minimize form joints and make watertight to prevent leakage of concrete.
    - a. Align joints symmetrically at exposed conditions.
  - 2. Chamfers: Provide chamfered edges and corners at exposed locations, unless specifically indicated otherwise on the drawings.
  - 3. Permanent openings: Provide openings to accommodate work of other trades, sized and located accurately. Securely support items built into forms; provide additional bracing at openings and discontinuities in formwork.
  - 4. Temporary openings: Provide temporary openings for cleaning and inspection in most inconspicuous locations at base of forms, closed with tight-fitting panels designed to minimize appearance of joints in finished concrete work.
- E. Tolerances for Formed Surfaces: Comply with minimum tolerances established in ACI 117, unless more stringent requirements are indicated on the drawings.
- F. Release Agent: Provide either form materials with factory-applied non-absorptive liner or field-applied form coating. If field-applied coating is employed, thoroughly clean and recondition formwork and reapply coating before each use.

### 3.2 REINFORCEMENT AND EMBEDDED ITEMS

- A. Preparation: Clean reinforcement of loose rust and mill scale, soil, and other materials which adversely affect bond with concrete.
- B. Placement: Place reinforcement to achieve not less than minimum concrete coverage as required for protection. Accurately position, support, and secure reinforcement against

displacement. Provide Class B tension lap splices complying with ACI 318 unless otherwise indicated. Do not field-bend partially embedded bars unless otherwise indicated or approved.

1. Use approved bar supports and tie wire, as required. Set wire ties to avoid contact with or penetration of exposed concrete surfaces. Tack welding of reinforcing is not permitted.
  2. Wire fabric: Install in maximum lengths possible, lapping adjoining pieces not less than one full mesh. Offset end laps to prevent continuous laps in either direction, and splice laps with tie wire.
- C. Welding: Welding of reinforcement is not permitted.
- D. Installation tolerances for anchor bolts for structural steel columns shall comply with the AISC Code of Standard Practice for Steel Buildings and Bridges.

### 3.3 JOINT CONSTRUCTION

- A. Construction Joints: Locate and install construction joints as indicated on drawings. If construction joints are not indicated, locate in manner which will not impair strength and will have least impact on appearance.
1. Keyways: Provide keyways not less than 1-1/2 inches deep.
  2. Reinforcement: Continue reinforcement across and perpendicular to construction joints, unless details specifically indicate otherwise.
  3. Waterstops: Provide waterstops as indicated, installing to form continuous, watertight dam, with field joints fabricated in strict accordance with manufacturer's instructions.
- B. Expansion Joints: Construct expansion joints where indicated. Install expansion joint filler to full depth of concrete. Recess edge of filler to depth indicated to receive joint sealant and backer rod where necessary.

### 3.4 PLACING CONCRETE

- A. The rate of delivery, haul time, missing time and hopper capacity shall be such that all mixed concrete delivered shall be placed in forms within 90 minutes from the time of the introduction of cement and water into the mixer.
- B. No water shall be added after transit mixer leaves the batching.
- C. Prepare previously placed concrete by cleaning and applying bonding agent in accordance with manufacturer's instruction.
- D. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with epoxy grout.
- E. Foundation surfaces against which concrete is to be placed must be free from standing water, mud and debris. Surfaces shall be clean and free from oil, objectionable coatings, and loose or unsound material.
- F. Placement in Forms: Limit horizontal layers to depths which can be properly consolidated, but in no event greater than 24 inches.
1. Consolidate concrete by means of mechanical vibrators, inserted vertically in freshly placed concrete in a systematic pattern at close intervals. Penetrate



previously placed concrete to ensure that separate concrete layers are knitted together.

2. Vibrate concrete sufficiently to achieve consistent consolidation without segregation of coarse aggregates.
  3. Do not use vibrators to move concrete laterally.
- G. Cold Weather Placement: Comply with recommendations of ACI 306 when air temperatures are expected to drop below 40 degrees F either during concrete placement operations or before concrete has cured.
1. Do not use frozen or ice-laden materials.
  2. Do not place concrete on frozen substrates.
- H. Hot Weather Placement: Comply with recommendations of ACI 305 when ambient temperature before, during, or after concrete placement is expected to exceed 90 degrees F or when combinations of high air temperature, low relative humidity, and wind speed are such that the rate of evaporation from freshly poured concrete would otherwise exceed 0.2 pounds per square foot per hour.
1. Do not add water to approved concrete mixes under hot weather conditions.
  2. Provide mixing water at lowest feasible temperature and provide adequate protection of poured concrete to reduce rate of evaporation.
  3. Use fog nozzle to cool formwork and reinforcing steel immediately prior to placing concrete.

### 3.5 FLOOR SLABS

- A. Place floor slabs on grade as indicated on drawings. Saw cut control joints at an optimum time after finishing. Cut slabs with a 3/16-inch (8 mm) thick blade to 1 inch (25 mm) depth. Locate control joints at a maximum spacing of 36 times the slab depth and at each corner and plan irregularity.
- B. Separate slabs on grade from vertical surfaces with joint filler. Extend joint filler from bottom of slab to within ¼ inch of finished slab surface.
- C. Construct slab on grade and shored elevated floor slabs with overall specified FF30/FL20 and with minimum FF15/FL10 for individual floor sections in accordance with ACI 302.1. Determination of FF/FL numbers will be in accordance with ASTM E 1155. The contractor will take remedial measures when floor slabs do not meet specified requirements.

### 3.6 FINISHING FORMED SURFACES

- A. Repairs: Repair surface defects, including tie holes, immediately after removing formwork.
  1. Remove honeycombed areas and other defective concrete down to sound concrete, cutting perpendicular to surface or slightly undercutting. Dampen patch location and area immediately surrounding it prior to applying bonding compound or patching mortar.
  2. Before bonding compound has dried, apply patching mixture matching original concrete in materials and mix except for omission of coarse aggregate, and using a blend of white and normal Portland cement as necessary to achieve color match. Consolidate thoroughly and strike off slightly higher than surrounding surface.

- B. Unexposed Form Finish: Repair tie holes and patch defective areas. Rub down or chip off fins or other raised areas exceeding 1/4 inch height.
- C. Exposed Form Finish: Repair and patch defective areas, with fins or other projections completely removed and smoothed.
  - 1. Smooth rubbed finish: Apply to surfaces indicated no later than 24 hours after form removal.
  - 2. Wet concrete surfaces to be finished and rub with abrasive until uniform color and texture are achieved.
  - 3. Do not apply separate grout mixture.
- D. Contiguous unformed surfaces: Strike smooth and float to a similar texture tops of walls, horizontal offsets, and other unformed surfaced adjacent to or contiguous with formed surfaces. Continue final finish of formed surfaces across unformed surfaces, unless otherwise specifically indicated.

### 3.7 CURING AND PROTECTION

- A. Working and walking on concrete shall be avoided for at least 24 hours after casting. Protect concrete from sun and rain. Do not permit concrete to become dry during curing period. Concrete shall not be subjected to any loads until concrete is completely cured, and until concrete has attained its 28 day strength and 14 days minimum.
- B. Protect concrete during and after curing from damage during subsequent building construction operations.
- C. Cover traffic areas with plywood or other suitable means for as long as necessary to protect concrete from damage.
- D. Immediately upon completion of finishing operation, the surface of slabs shall be sealed against moisture loss by the application of one of the following methods for 7 days:
  - 1. Apply a curing blanket made of polyethylene bonded to burlap in accordance with the manufacturer's instructions.
  - 2. Apply waterproof curing paper with edges lapped and sealed with tape. The curing membrane shall be weighted down. Tears and rips in curing membrane shall be repaired immediately during curing period.
- E. Specific curing requirements for walls, beams and columns shall include the following:
  - 1. Concrete in forms shall be kept moist until removal.
  - 2. Immediately upon removal of forms, an approved sprayed-on curing compound shall be applied to the concrete surfaces in strict compliance with the manufacturer's recommendations.
  - 3. Curing shall be maintained for 7 days.

### 3.8 MISCELLANEOUS CONCRETE ITEMS

- A. Fill-in: Fill in holes and openings left in concrete structures for passage of work by other trades after such work is in place. Place such fill-in concrete to blend with existing construction, using same mix and curing methods.
- B. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Screed, tamp, and finish concrete surfaces as scheduled.

- C. Reinforced Masonry: Provide concrete grout for reinforced masonry where indicated on drawings and as scheduled.

### 3.9 FIELD QUALITY CONTROL

- A. Composite Sampling and Making and Curing of Specimens: ASTM C172 and ASTM C31.
1. Take samples at point of discharge.
  2. For pumped concrete, perform sampling and testing at the frequencies specified herein at point of delivery to pump, and perform additional sampling and testing at the same frequency at discharge from line. Results obtained at point of delivery shall be used for acceptance of concrete.
  3. Take samples and perform tests for concrete before and after field addition of admixtures. Report results of all tests.
- B. Slump: ASTM C143. Test first 2 loads delivered for each pour and 1 test per strength test and additional tests if concrete consistency changes.
1. Modify sampling to comply with ASTM C94.
  2. For concrete containing superplasticizer added at the job site, perform slump test prior to addition of admixture and after mixing. Report both test results.
  3. Visual estimate of slump may be accepted once uniform results are achieved over a minimum of 4 samples. Report all estimated results as such.
- C. Air Content of concrete: ASTM C173 or ASTM C231. Test first 2 loads delivered for each pour and one test per strength test performed on air-entrained concrete.
- D. Concrete Temperature:
1. Test hourly when air temperature is 40 degrees F or below.
  2. Test hourly when air temperature is 90 degrees F or above.
  3. Test each time a set of strength test specimens is made.
- E. Compressive Strength Tests: ASTM C39.
1. Compression test specimens: Mold and cure one set of 4 standard cylinders for each compressive strength test required.
  2. Testing for acceptance of potential strength of as-delivered concrete:
    - a. Obtain samples on a statistically sound, random basis.
    - b. Provide one test per 50 cubic yards or fraction thereof for each day's pour of each concrete class.
    - c. Provide one test per 2500 square feet of slab or wall area or fraction thereof for each day's pour of each concrete class.
    - d. When the above testing frequency would provide fewer than 5 strength tests for a given class of concrete during the project, conduct testing from not less than 5 randomly selected batches or from each batch if fewer than 5.
    - e. Test one specimen per set at 7 days for information unless an earlier age is required.
    - f. Test 2 specimens per set for acceptance of strength potential; test at 28 days unless other age is specified. The test result shall be the average of the two specimens. If one specimen shows evidence of improper sampling, molding, or testing, the test result shall be the result of the remaining specimen; if both show such evidence, discard the test result and inform the engineer.

- g. Retain one specimen from each set for later testing, if required.
  - h. Strength potential of as-delivered concrete will be considered acceptable if all of the following criteria are met:
    - i. No individual test result falls below specified compressive strength by more than 500 psi.
    - ii. Not more than 10 percent of individual test results fall below specified compressive strength.
    - iii. Average of any 3 consecutive strength test results equals or exceeds specified compressive strength.
  - i. Evaluate construction and curing procedures and implement corrective action when strength results for field-cured specimens are less than 85 percent of test values for companion laboratory-cured specimens.
- F. Test Results: Testing agency shall report field and laboratory test results in writing to engineer and contractor within 24 hours of test.
- 1. Field test results which do not comply with the project specifications shall be immediately reported to project superintendent. Field reports shall include documentation of all such reports and the name of the person results were reported to.
  - 2. Test reports shall contain the following data:
    - a. Project name, number, and other identification.
    - b. Name of concrete testing agency.
    - c. Date and time of sampling.
    - d. Concrete type and class.
    - e. Location of concrete batch in the completed work.
    - f. All information required by respective ASTM Test methods.
    - g. Concrete mix parameters and tolerances.
  - 3. Nondestructive testing may be used at engineer's option for assistance in determining probable concrete strength at various locations or for selecting areas to be cored, but such tests shall not be the sole basis for acceptance or rejection.
  - 4. The testing agency shall make additional tests of in-place concrete as directed by the engineer when test results indicate that specified strength and other concrete characteristics have not been attained.
    - a. Testing agency may conduct tests of cored cylinders complying with ASTM C42, or tests as directed.
    - b. Cost of additional testing shall be borne by the contractor when unacceptable concrete has been verified.

END OF SECTION 033000

## SECTION 035400 - CONCRETE UNDERLAYMENT PATCH

### PART I – GENERAL

#### 1.01 SUMMARY

- A. This is the recommended specification for ARDEX SD-P InstantPatch, Self-Drying, Fast-Setting, Concrete Underlayment Trowelable Patch for smoothing and repairing concrete floors, ramps, stairways, as well as non-porous substrates such as terrazzo, ceramic and quarry tile prior to the installation of floor covering.

#### 1.02 SECTION INCLUDES

- A. ARDEX SD-P InstantPatch Self-Drying, Fast-Setting Concrete Underlayment Patch.
- B. ARDEX LU-100 Self-Leveling Floor Underlayment
- C. ARDEX P-51 Primer
- D. ARDEX P-82 Ultra Prime.
- E. Architect/Engineer Approved Equal.

#### 1.03 QUALITY ASSURANCE

- A. Installation of the cement-based, self-drying, fast-setting trowelable underlayment patch must be made by the applicator using mixing equipment and tools approved by the manufacturer.
- B. Installation of the hydraulic cement-based, self-leveling underlayment must be by an applicator using mixing equipment and tools approved by the manufacturer.
- C. Provide ARDEX SD-P InstantPatch Self-Drying, Fast-Setting Concrete Underlayment Patch as manufactured by ARDEX INC., 400 Ardex Park Drive, Aliquippa, PA 15001.
- D. Underlayment shall be installed from a featheredge to ¼" over any size area, up to ½" in areas of 20 sq. ft. or less and up to 1" deep in areas up to 4 sq. ft.
- E. Underlayment shall be able to be installed from a featheredge to 2" in one pour and up to 5" thick in small areas.
- F. Underlayment shall develop a minimum compressive strength of 4200 psi after 28 days per ASTM C109/mod (air cure only).
- G. No primer is required for underlayment when used over standard absorbent concrete.
- H. Underlayment shall be able to be covered by most flooring materials as soon as the surface is sufficiently hardened (usually within an hour). Parquet, athletic flooring and flooring requiring special adhesives shall be installed in 16 hours.
- I. Underlayment shall be walkable after 3 hours at 70°F and be able to be covered by finish flooring material in 2-3 days, depending upon thickness of installation.

#### 1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in their unopened packages and protect from extreme temperatures and moisture. Protect liquids from freezing.

#### 1.05 SITE CONDITIONS

- A. ARDEX SD-P is a cementitious material. Observe the basic rules of concrete work. Do not install below 50°F surface temperature. Install quickly if floor is warm and follow hot weather precautions available from the ARDEX Technical Service Department. Never mix with cement or additives other than ARDEX-approved products.
- B. ARDEX LU-100 contains blended hydraulic cements and powdered polymers. Do not install in applications on or below grade unless the concrete substrate has already been treated with ARDEX MC™ MOISTURE CONTROL SYSTEM or approved equal. Do not install below 50°F surface temperature. Install quickly if floor is warm and follow hot weather precautions available from the Ardex Technical Service Department. Never mix with cement or additives.

### PART 2 – PRODUCTS

#### 2.01 MATERIALS

- A. The Portland cement-based, self-drying, fast-setting, trowelable underlayment patch shall be ARDEX SD-P InstantPatch Self-Drying, Fast-Setting Concrete Underlayment Patch.
- B. No primer required over standard absorbent concrete.
- C. Primer for non-porous, and highly smooth substrates, shall be ARDEX P-82 Ultra Prime.
- D. Water shall be clean, potable, and sufficiently cool (not warmer than 70°F).
- E. The hydraulic cement-based self-leveling underlayment shall be ARDEX LU-100 SELF-LEVELING FLOORING UNDERLAYMENT.
- F. Primer for standard absorbent concrete subfloors, well bonded patching compounds, and other porous surfaces shall be ARDEX P 51 PRIMER diluted 1:1 with water.
- G. Primer for well-bonded, non-water soluble adhesive residues shall be ARDEX P 51 PRIMER undiluted or ARDEX P 82 ULTRA PRIME.
- H. Primer for all other non-porous surfaces to include terrazzo, burnished or sealed concrete, ceramic and quarry tile, acrylic curing compounds, and epoxy coatings shall be ARDEX P 82 ULTRA PRIME.
- I. Water shall be clean, potable, and sufficiently cool (not warmer than 70°F)
- J. Repair of small gouges, indentations and holes, as well as skim coating large areas, can be done using ARDEX FEATHER FINISH® SELF-DRYING, CEMENT-BASED FINISHING UNDERLAYMENT.

#### 2.02 MIX DESIGNS

- A. Mixing Ratios: Standard mixing ratio: Mix 1 bag of ARDEX SD-P (40 lbs.) with 4 quarts of water. Product can be mixed in a clean 5-gallon pail using ARDEX T-2 Mixing Paddle and a ½" heavy-duty drill (min. 650 rpm). Mix thoroughly for approximately 2-3 minutes to obtain a lump-free mixture. Follow written instructions per ARDEX SD-P bag label.
- B. Underlayment shall be installed using a wood or magnesium float. When underlayment begins to harden, finish with a steel trowel.
- C. Underlayment can receive floor covering as soon as the surface becomes sufficiently hard (about 1 hour). Parquet, athletic flooring and flooring requiring special adhesives can be installed in 16 hours.
- D. Mixing Ratio: ARDEX LU-100 is mixed in 2-bag batches at one time. Mix each bag of ARDEX LU-100 (50 lb.) with 4 quarts of water. Product shall be mixed in an ARDEX T- 10 Mixing Drum using an ARDEX T-4 Mixing Paddle and a ½" heavy-duty drill (min. 650rpm). Mix thoroughly for approx. 2-3 minutes to obtain a lump-free mixture. Follow written instructions per the ARDEX LU-100 bag label.
- E. For pump installations, ARDEX LU-100 shall be mixed using the ARDEX Levelcraft Automatic Mixing Pump. Start the pump at 130 gallons of water per hour, then adjust to the minimum water reading which still allows self-leveling properties. DO NOT OVERWATER! Check the consistency of the product on the floor to ensure a uniform distribution of the sand aggregate at both the top surface and bottom of the pour. If settling is occurring, reduce the water amount and recheck. Conditions during the installation, such as variations in water, powder, substrate, and ambient temperature, require that the water setting be monitored and adjusted carefully to avoid overwatering.

## PART 3 – EXECUTION

### 3.01 PREPARATION

- A. All surfaces must be sound, solid, cleaned, and where required, properly primed.
- B. All concrete subfloors must be of adequate strength, clean, and free of oil, grease, dirt, curing compounds, and any substance, which might act as a bondbreaker. Mechanically clean, if necessary, using shot blasting or other. Acid etching and the use of sweeping compounds and solvents are not acceptable.
- C. All non-porous substrates such as ceramic tile, terrazzo, etc., must be well bonded, clean and free of wax, dressings and sealers. If necessary, have the surface professionally cleaned.
- D. All cracks in the subfloor shall be repaired to minimize telegraphing through the underlayment.
- E. Substrates shall be tested and corrected for moisture and for any other condition, which could affect the performance of the underlayment and the finish floor covering, before installing the patch.
- F. All concrete subfloors and concrete floors with existing patching must be solid, sound, solid, thoroughly cleaned, and properly primed.
  - 1. All concrete subfloors must be of adequate strength, clean, and free of all oil, grease, dirt, curing compounds and any substance, which might act as a bondbreaker. Mechanically clean, if necessary, using shot blasting or other. Acid etching and the use of sweeping compounds and solvents are not acceptable.

2. All cracks in the subfloor shall be repaired to minimize telegraphing into the underlayment.
  3. Subfloors shall be inspected and corrected for moisture or any other conditions which could affect the performance of the underlayment or finished floor covering.
- G. Priming
1. No primer required for porous concrete floors.
  2. Primer for non-porous substrates.
  3. Prime with ARDEX P-82 Ultra Prime. Mix Part A (red) and Part B (white) and apply evenly with a short-nap or foam paint roller, leaving a thin coat of primer no heavier than a thin coat of paint. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry to a clear, slightly tacky film (min. 3 hours, max. 24 hours). Underlayment shall not be applied until primer is dry.
  4. Primer coverage approximately 200 to 400 square feet per gallon.
- H. Priming ARDEX LU-100 Priming
1. Extremely absorbent substrates
    - i. Mix ARDEX P-51 3:1 with water and apply evenly with a soft pushbroom. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry to a clear, thin film (One to three hours). Second coat of Primer shall not be applied until initial primer application is completely dry.
    - ii. Mix ARDEX P-51 1:1 with water and apply evenly with a soft pushbroom. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry to a clear, thin film (minimum 3 hours, maximum 24 hours). ARDEX LU- 100 Underlayment shall not be installed until second primer application is completely dry.
  2. Non-water soluble adhesive residues – Use ARDEX P 51 PRIMER at full strength and install as above.
  3. Non-porous substrates: Prime with ARDEX P 82 ULTRA PRIME. Mix Part A (red) with Part B (white) and apply with a short-nap or sponge paint roller, leaving a thin coat of primer no heavier than a thin coat of paint. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry to a clear, slightly tack film (minimum 3 hours, maximum 24 hours). Underlayment shall not be installed until primer is dry. Primer coverage is approximately 200 to 400 square feet per gallon.

### 3.02 APPLICATION OF UNDERLAYMENT

- A. Pour or pump the ARDEX LU-100 and spread with the ARDEX T-4 Spreader. Use the ARDEX T-5 Smoother for featheredge and touch-up. Wear baseball shoes with nonmetallic cleats to avoid leaving marks in the ARDEX LU-100. Underlayment can be carefully walked on in 3 hours at 70°F.

### 3.03 PREPARATION FOR FLOORING INSTALLATION



- A. Underlayment can accept finish floor covering materials after 2-3 days at 70°F/50% R.H. depending upon thickness. Perform a moisture test in accordance with ASTM D4263 before installing the finish flooring.

#### 3.04 FIELD QUALITY CONTROL

- A. Where specified, field sampling of the Ardex topping is to be done by taking an entire unopened bag of the product being installed to an independent testing facility to perform compressive strength testing in accordance with ASTM C 109/modified: air-cure only. There are no in situ test procedures for the evaluation of compressive strength.

#### 3.05 PROTECTION

- A. Prior to the installation of the finish topping, the surface of the underlayment should be protected from abuse by other trades by the use of plywood, Masonite or other suitable protection course.

END OF SECTION 035400



## SECTION 035416 – CEMENT-BASED, INTERIOR, SELF LEVELING UNDERLAYMENT

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

#### 1.02 SUMMARY

- A. Cement-based, interior, self-leveling underlayment.

#### 1.03 SECTION INCLUDES

- A. Cement-based, interior, self-leveling underlayment used to create a smooth, flat or level surface prior to the installation of floor coverings.
  - 1. Cement-based, interior, self-leveling underlayment
  - 2. Primer
  - 3. Vapor mitigation product
  - 4. Fiber reinforcement material
  - 5. Finishing underlayment compound
- B. Related Sections include the following:
  - 1. Section 033000, Cast-In-Place Concrete
  - 2. Division 09 Flooring Sections

#### 1.04 REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
- C. All materials, installation and workmanship shall comply with all applicable requirements and standards.
- D. ASTM C109M, Compressive Strength Air-Cure Only
- E. ASTM C348, Flexural Strength of Hydraulic Cement Mortars
- F. ASTM C190, Method of Test for Tensile Strength of Hydraulic Cement Mortars

- G. ASTM C1583, Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension
- H. ASTM C4541, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
- I. ASTM F2170, Relative Humidity in Concrete Floor Slabs Using in situ Probes
- J. ASTM F1869, Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
- K. ASTM 710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
- L. Resilient Floor Covering Institute booklet "Recommended Work Practices for the Removal of Resilient Floor Coverings"

#### 1.05 QUALITY ASSURANCE

- A. Installation of CMP SPECIALTY PRODUCTS LEVEL-1 must be by a trained applicator regularly engaged and properly equipped for application of concrete floor underlayment. Please contact your local CMP SPECIALTY PRODUCTS distributor for a list of Installers.
- B. Product shall be able to be installed from ¼ inch to 3 inches thickness neat and up to 5-inches properly extended with aggregate over well-defined areas.
- C. Product shall be formulated to develop a compressive strength of 5000 psi when tested in accordance with ASTM C109/modified for air-cured conditions.
- D. Product shall be able to be covered by thinset ceramic tile in 24 hours, water-based sealers and adhesives for standard coverings in 48 hours, epoxy or urethane adhesives and moisture sensitive coverings in 3 to 5 days. For application of epoxy coatings < 20 mils: 24 hours and high build epoxy coatings > 20 mils: 5 to 7 Days. Always ensure underlayment is totally dry especially when using moisture sensitive adhesive and floor coverings.
- E. Product produces a hard-durable surface that can be left open to normal construction traffic for up to one year before the installation of finished flooring. CMP SPECIALTY PRODUCTS LEVEL-1 can be feather edged to meet existing transitions.

#### 1.06 SUBMITTALS

- A. Product Data: Product data in the form of technical data, specifications, and installation instructions.

#### 1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's original undamaged packages or acceptable bulk containers.
- B. Store packaged materials to protect them from elements or physical damage.
- C. Do not use which shows indications of moisture damage, caking, or other signs of deterioration.

## 1.08 PROJECT CONDITIONS

- A. Do not place the product when ambient temperature is below 50 degrees F (10 degrees C) or above 95 degrees F (35 degrees C).

## PART 2 – PRODUCTS

### 2.01 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

### 2.02 MATERIALS

- A. Self-Leveling Underlayment: Free-flowing, self-leveling, pumpable, cement-based compound for applications from 1/4 inch to 3 inches. Applications up to 5 inches in thickness properly extended with aggregate.

#### BASIS OF DESIGN

- 1. CMP SPECIALTY PRODUCTS “LEVEL-1”
  - a. Flow Working Time: 25 minutes
  - b. Final Set: Approximately 90 minutes, ASTM C191
  - c. Compressive Strength:
    - i. 1500 psi at 1 day, ASTM C109M
    - ii. 3000 psi at 7 days, ASTM C109M
    - iii. 5000 psi at 28 days, ASTM C109M
  - d. Flexural Strength: 1000 psi at 28 days, ASTM 348
  - e. Tensile Strength: 520 psi at 28 days, ASTM C190
  - f. VOC: 0g/L, calculated SCAQMD 1168
- 2. Architect Approved Equal
- B. Underlayment Primer: Premium primer designed for use with CMP’s line of underlayments and toppings.
  - 1. CMP SPECIALTY PRODUCTS “AS-100”
  - 2. CMP SPECIALTY PRODUCTS “LOCKDOWN” with sand broadcast. Note: CMP SPECIALTY PRODUCTS LOCK DOWN with sand broadcast is required for applications subject to dynamic rolling loads and when CMP SPECIALTY PRODUCTS LEVEL-1 is used as a prefill for CMP SPECIALTY PRODUCTS DIAMOND CAP installations.
- C. Vapor Mitigation and Remediation Product: 100% solids, two-component, resin based, membrane forming, moisture mitigation system.

1. CMP SPECIALTY PRODUCTS "LOCKDOWN"

- D. Redispersible Fiber Mat: Fiber reinforcement mat for use with wood, unstable and distressed subfloors.

1. CMP SPECIALTY PRODUCTS "MEDIMAT"

- E. Finishing Underlayment Compound: Trowelable, cement-based smoothing compound for applications from feather edge to ½ inch thick.

1. CMP SPECIALTY PRODUCTS "PREPSTAR"

- F. Polished, Self Leveling Topping: Calcium Aluminate/Portland cement based self-leveling topping for applications from 1/4 inch to 2 inches thickness and suitable to receive a mechanical concrete polish process.

1. CMP SPECIALTY PRODUCTS DIAMOND CAP

- G. Self Leveling Topping: Premium free-flowing, self-leveling, pumpable, calcium aluminate/Portland cement-based compound for applications from 1/8 inch to 1/2 inch thickness.

1. CMP SPECIALTY PRODUCTS LIQUICEM

- H. Aggregate: For extension on CMP SPECIALTY PRODUCTS LEVEL-1 in 3 inch to 5 inch thick applications.

2.03 MIXING EQUIPMENT

- A. Provide suitable batch type mechanical mixer for mixing topping material at the Project Site. Equip batch mixer with a suitable charging hopper, water storage tank, and a water-measuring device. Use only mixers which are capable of mixing aggregates, cement, and water into a uniform mix within specified time, and of discharging mix without segregation.
- B. Provide suitable mixing-pump such as m-tec, Duo 2000 which includes dual mixing action and wet material probe for consistent mix water monitoring.
- C. Provide a suitable barrel, to mix 2-bag batches of product. Provide a suitable dispensing container for measuring a maximum 5.5 quarts of clean cold water for each bag of product. Provide a heavy duty 1/2" drill (min. 850 rpm) with product mixing wand to mix product to a lump free consistency without entraining excess air.

PART 3 - EXECUTION

3.01 PREPARATION (BASIS OF DESIGN PRODUCT)

- A. Concrete subfloors: Prepare substrate in accordance with CMP SPECIALTY PRODUCTS' instructions.
1. Refer to ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring before proceeding.
2. Concrete subfloors must be sound, clean and free of all dirt, oil, grease, laitance, curing compounds and any substance that may act as a bond breaker. If necessary, mechanically clean and remove contaminants by chipping, shot-blasting, grinding or scarifying. Removal with solvents, strippers and acid etching are not acceptable.

3. All cracks in the subfloor must be repaired or treated to minimize crack telegraphing through the underlayment/topping. Moving cracks, working cracks, expansion joints and isolation joints must be honored through the applied CMP SPECIALTY PRODUCTS LEVEL-1.
  4. Substrates shall be inspected and tested for moisture in accordance with ASTM F1869 and/or ASTM 2170. Substrates must be corrected for moisture or any other conditions that could affect the underlayment/topping performance or finished floor covering. Utilize CMP SPECIALTY PRODUCTS LOCKDOWN topical moisture vapor mitigation system where moisture and vapor emissions exceed the floor covering manufacturer's required limits.
- B. Wooden subfloors: Requires the use of CMP SPECIALTY PRODUCTS MEDIMAT™ redispersible fiber reinforcement mat.
1. Must be a minimum of  $\frac{3}{4}$  inch, untreated, APA Rated, Type-1, exterior grade plywood, OSB or equal. The subfloor must be free of deflection (L/360 maximum) considering both live and dead loads. Subfloor must be clean, sound and free of all foreign matter that will inhibit bond.
  2. Prepare by sanding down to bare wood. Secure loose boards with deck screws and fill open seams with CMP SPECIALTY PRODUCTS PREPSTAR. Replace any weak or water damaged wood.
  3. Use an approved anti-fracture membrane over CMP SPECIALTY PRODUCTS LEVEL-1 in areas where Ceramic Tile or Stone are being installed.
- C. Non-Porous floors: Epoxy, Terrazzo, and ceramic and quarry tile must be abraded to a dull finish. Vacuum or wet vacuum the surface to remove dust and laitance.
- D. Adhesive residue: Thin, translucent adhesive residue must be non-water soluble, free of tack and well bonded to the substrate. The adhesive Cutback must be prepared using the wet scrape method as outlined in the Resilient Floor Covering Institute booklet "Recommended Work Practices for the Removal of Resilient Floor Coverings". Remove all patching materials below the adhesive and avoid applications where heat or excessive moisture will soften or degrade the adhesive. If unsure about the suitability, deflection or if heavy loads are expected, use the VERY DISTRESSED SUBFLOORS Application Method below.
- E. Very distressed subfloors: Requires the use of CMP SPECIALTY PRODUCTS MEDIMAT™ redispersible fiber reinforcement mat for use with wood, unstable and distressed subfloors.
1. ALL substrates must be clean, dry, between 50° and 95°F (10° and 30°C) and free of oil, loose (floorcovering, patching compounds or surface material). Remaining materials must be unaffected by the moisture incurred from the placement of self-leveling. Never use Acid or Mastic Removers on any surface to which a CMP product will be applied.
- F. Gypsum substrates: Requires the use of CMP SPECIALTY PRODUCTS MEDIMAT™ redispersible fiber reinforcement mat.
1. Remove all loose debris from subfloor. Sweep and vacuum the substrate.

- G. Metal substrates: Substrate must be prepared by abrasive cleaning to a White metal finish, structurally sound and free of deflection (L/360 maximum). Remove all residue using a dry cleaning method or wipe down with Xylene.

### 3.02 INSTALLATION (BASIS OF DESIGN PRODUCT)

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installation shall be in accordance with CMP SPECIALTY PRODUCTS published recommendations.
- C. Concrete subfloors: Apply one coat of CMP SPECIALTY PRODUCTS AS-100 diluted 50/50 (1 part water: 1 part CMP SPECIALTY PRODUCTS AS-100) using a split tip broom. Pour out and work into surface leaving no puddles or bare spots. Apply CMP SPECIALTY PRODUCTS LEVEL-1 once CMP SPECIALTY PRODUCTS AS-100 is dry (Minimum 1 hour) and up to 24 hours. If primer has dried longer than 24 hours, a second coat of CMP SPECIALTY PRODUCTS AS-100 may be required.
- D. Wooden subfloors: Requires the use of CMP SPECIALTY PRODUCTS MEDIMAT™ redispersible fiber reinforcement mat.
  - 1. Apply one thin coat of CMP SPECIALTY PRODUCTS AS-100 (Undiluted) using a 3/8 inch nap roller. Apply CMP SPECIALTY PRODUCTS LEVEL-1 once CMP SPECIALTY PRODUCTS AS-100 is dry (Minimum 2 hours) and up to 24 hours. If CMP SPECIALTY PRODUCTS AS-100 has dried longer than 24 hours, a second coat of CMP SPECIALTY PRODUCTS AS-100 may be required.
  - 2. Roll out CMP SPECIALTY PRODUCTS MEDIMAT over the properly prepared and primed surface. Overlap all seams a minimum of 1 inch and cut to fit using scissors. A single layer of CMP SPECIALTY PRODUCTS MEDIMAT can be used to reinforce CMP SPECIALTY PRODUCTS LEVEL-1 applications up to 1 inch thick. Place an additional layer of mat for thicknesses up to 2". Mat installation does not need to be "Wrinkle Free" as the product breaks down into individual fibers after the CMP SPECIALTY PRODUCTS LEVEL-1 is placed.
  - 3. Place a minimum of ½ inch of CMP SPECIALTY PRODUCTS LEVEL-1 over CMP SPECIALTY PRODUCTS MEDIMAT.
  - 4. Once the mat is covered, gauge rake. Working the underlayment in a crosshatch pattern with a CMP SPECIALTY PRODUCTS Porcupine or Agitating Roller may be required to properly disperse the fiber; fibers should be visible in the CMP SPECIALTY PRODUCTS LEVEL-1. Pouring or pumping the self-leveling back into already placed material will help in dispersing the fibers.
  - 5. Finish with a CMP SPECIALTY PRODUCTS smoother.
  - 6. Depending on the sensitivity of finished covering, sanding or skim coating using CMP SPECIALTY PRODUCTS PREPSTAR trowelable underlayment or capping with CMP SPECIALTY PRODUCTS LEVEL-1 or CMP SPECIALTY PRODUCTS LIQUICEM may be required to suppress any residual fiber texture remaining in the CMP SPECIALTY PRODUCTS LEVEL-1.



- E. Non-Porous floors: Apply one thin coat of CMP SPECIALTY PRODUCTS AS-100 (Undiluted) using a ¼ inch nap roller. Apply CMP SPECIALTY PRODUCTS LEVEL-1 once CMP SPECIALTY PRODUCTS AS-100 is dry (Minimum 1 hour) and up to 24 hours. If CMP SPECIALTY PRODUCTS AS-100 has dried longer than 24 hours, a second coat of CMP SPECIALTY PRODUCTS AS-100 may be required.
- F. Adhesive residue: Apply one thin coat of CMP SPECIALTY PRODUCTS AS-100 (Undiluted) using a 3/8 inch nap roller. Apply CMP SPECIALTY PRODUCTS LEVEL-1 once CMP SPECIALTY PRODUCTS AS-100 is dry (Minimum 2 hours) and up to 24 hours. If CMP SPECIALTY PRODUCTS AS-100 has dried longer than 24 hours, a second coat of CMP SPECIALTY PRODUCTS AS-100 may be required.
- G. Very distressed subfloors: Requires the use of CMP SPECIALTY PRODUCTS MEDIMAT™ redispersible fiber reinforcement mat.
  - 1. Apply one thin coat of CMP SPECIALTY PRODUCTS AS-100 (Undiluted) using a 3/8 inch nap roller. Apply CMP SPECIALTY PRODUCTS LEVEL-1 once CMP SPECIALTY PRODUCTS AS-100 is dry (Minimum 2 hours) and up to 24 hours. If CMP SPECIALTY PRODUCTS AS-100 has dried longer than 24 hours, a second coat of CMP SPECIALTY PRODUCTS AS-100 may be required.
  - 2. Roll out CMP SPECIALTY PRODUCTS MEDIMAT™ over the properly prepared and primed surface. Overlap all seams a minimum of 1 inch and cut to fit using scissors. A single layer of CMP SPECIALTY PRODUCTS MEDIMAT™ can be used to reinforce CMP SPECIALTY PRODUCTS LEVEL-1 applications up to 1 inch thick. Place an additional layer of mat for thicknesses up to 2 inches. Mat installation does not need to be “Wrinkle Free” as the product breaks down into individual fibers after the CMP SPECIALTY PRODUCTS LEVEL-1 is placed.
  - 3. Place a minimum of ½ inch of CMP SPECIALTY PRODUCTS LEVEL-1 over CMP SPECIALTY PRODUCTS MEDIMAT.
  - 4. Once the mat is covered, gauge rake. Working the underlayment in a crosshatch pattern with a CMP SPECIALTY PRODUCTS Porcupine or Agitating Roller may be required to properly disperse the fiber; fibers should be visible in the CMP SPECIALTY PRODUCTS LEVEL-1. Pouring or pumping the self-leveling back into already placed material will help in dispersing the fibers.
  - 5. Finish with a CMP SPECIALTY PRODUCTS smoother.
  - 6. Depending on the sensitivity of finished covering, sanding or skim coating using CMP SPECIALTY PRODUCTS PREPSTAR trowelable underlayment or capping with CMP SPECIALTY PRODUCTS LEVEL-1 or CMP SPECIALTY PRODUCTS LIQUICEM may be required to suppress any residual fiber texture remaining in the CMP SPECIALTY PRODUCTS LEVEL-1.
- H. Gypsum substrates: Requires the use of CMP SPECIALTY PRODUCTS MEDIMAT redispersible fiber reinforcement mat.
  - 1. The first primer coat should be diluted and applied at 1 part CMP SPECIALTY PRODUCTS AS-100: 3 parts water using a split tip Broom. Pour out and work into surface leaving no puddles or bare spots.

2. After initial coat is dry (Minimum 1 hour) apply the second coat of CMP SPECIALTY PRODUCTS AS-100 diluted 50/50 (1 part water: 1 part CMP SPECIALTY PRODUCTS AS-100) using a split tip broom. Pour out and work into surface leaving no puddles or bare spots.
3. Install CMP SPECIALTY PRODUCTS MEDIMAT™ as per TDS once CMP SPECIALTY PRODUCTS AS-100 is completely dry (Minimum 2 hours) and up to 24 hours. If Primer has dried longer than 24 hours, an additional coat of CMP SPECIALTY PRODUCTS AS-100 may be required.
4. Roll out CMP SPECIALTY PRODUCTS MEDIMAT™ over the properly prepared and primed surface. Overlap all seams a minimum of 1 inch and cut to fit using scissors. A single layer of CMP SPECIALTY PRODUCTS MEDIMAT™ can be used to reinforce CMP SPECIALTY PRODUCTS LEVEL-1 applications up to 1 inch thick. Place an additional layer of mat for thicknesses up to 2 inches. Mat installation does not need to be "Wrinkle Free" as the product breaks down into individual fibers after the CMP SPECIALTY PRODUCTS LEVEL-1 is placed.
5. Place a minimum of ½ inch of CMP SPECIALTY PRODUCTS LEVEL-1 over CMP SPECIALTY PRODUCTS MEDIMAT.
6. Once the mat is covered, gauge rake. Working the underlayment in a crosshatch pattern with a CMP SPECIALTY PRODUCTS Porcupine or Agitating Roller may be required to properly disperse the fiber; fibers should be visible in the CMP SPECIALTY PRODUCTS LEVEL-1. Pouring or pumping the self-leveling back into already placed material will help in dispersing the fibers.
7. Finish with a CMP SPECIALTY PRODUCTS smoother.
8. Depending on the sensitivity of finished covering, sanding or skim coating using CMP SPECIALTY PRODUCTS PREPSTAR trowelable underlayment or capping with CMP SPECIALTY PRODUCTS LEVEL-1 or CMP SPECIALTY PRODUCTS LIQUICEM may be required to suppress any residual fiber texture remaining in the CMP SPECIALTY PRODUCTS LEVEL-1.

### 3.03 MIXING (BASIS OF DESIGN PRODUCT)

- A. Use CMP SPECIALTY PRODUCTS mixing drum, to mix 2-bag batches of CMP SPECIALTY PRODUCTS LEVEL-1. Add a maximum 5.5 quarts of clean cold water for each bag of CMP SPECIALTY PRODUCTS LEVEL-1 to the mixing drum or barrel. Then, add bags of CMP SPECIALTY PRODUCTS LEVEL-1 while mixing at full speed with a CMP SPECIALTY PRODUCTS mixing wand attached to a heavy duty ½ inch drill (min. 850 rpm). Mix for 2 minutes or until lump free. Add no additional water and keep the mixing wand immersed in the material to avoid entraining excess air.
- B. Aggregate mix: For installation areas over 2 inches (5 cm) in thickness, up to 1 part by volume of well graded, washed pea gravel must be added. Aggregates should be hard, high density and non-absorbent. Before attempting to use any aggregate, conduct testing to determine suitability. All aggregate should be clean and dry. Do not use sand or exceed 1 part aggregate by volume. Combine aggregate once material is lump free and mix until aggregate is completely coated. Aggregate addition will diminish workability and may make it necessary to install a finish layer. Allow the first installation to dry 12 to 16 hours before topping.

- C. For pump installations, please contact CMP SPECIALTY PRODUCTS for instructions, recommended pumping procedures and approved equipment.

#### 3.04 PLACING (BASIS OF DESIGN PRODUCT)

- A. Place underlayment in accordance with CMP SPECIALTY PRODUCTS' instructions, using equipment and procedures to facilitate continuous placement, avoid segregation of mix and prevent excessive air content. Pour or pump, gauge rake with a CMP SPECIALTY PRODUCTS gauge rake and smooth with a CMP SPECIALTY PRODUCTS smoother in a continuous operation until an entire panel or section of floor area are completed. Do not work mix except for raking or smoothing.

#### 3.05 CURING AND PROTECTION (BASIS OF DESIGN PRODUCT)

- A. Cure and protect CMP SPECIALTY PRODUCTS LEVEL-1 underlayment/topping applications and finishes as specified CMP SPECIALTY PRODUCTS. CMP SPECIALTY PRODUCTS LEVEL-1 is self-curing. Do not use cure & seals or any other curing methods.
- B. During application and for the first 24 hours, prevent excessive air movement but maintain adequate ventilation and protect material from direct sunlight to prevent uneven curing patterns, false set and cracking.

#### 3.06 PERFORMANCES (BASIS OF DESIGN PRODUCT)

- A. Failure of CMP SPECIALTY PRODUCTS LEVEL-1 to bond to substrate, or disintegration or other failure of topping to perform as a floor underlayment or topping compound will be considered failure of materials and/or workmanship. Repair or replace CMP SPECIALTY PRODUCTS LEVEL-1 in areas of such failures, as directed by CMP SPECIALTY PRODUCTS.

END OF SECTION 035416



## SECTION 054000 - COLD FORMED STEEL FRAMING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Load bearing and non-load bearing metal wall framing.
  - 2. Metal floor and ceiling joist framing.
  - 3. Formed steel sections, 14 gauge and lighter, for use as bracing, bridging, tracks, furring and fastening.

#### 1.2 REFERENCES

- A. AISI "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. AISI "Standard for Cold-Formed Steel Framing General Provisions."

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Engineer, fabricate, and erect cold formed steel framing and connections to withstand design loads within limits and under conditions required.
  - 1. Floor framing members shall withstand design loads without vertical deflections greater than  $1/360$  of the span.
  - 2. Roof framing members shall withstand design loads without vertical deflections greater than  $1/240$  of the span.
  - 3. Wall framing members shall withstand design loads without horizontal deflections greater than  $1/360$  of the span.
  - 4. Wall framing members supporting masonry veneer shall withstand design loads without horizontal deflections greater than  $1/600$  of the span.
- B. Design framing systems to accommodate movement of the structural framing without damage or overstress to members, connections or sheathing.
- C. Engineering Responsibility: Engage a cold formed steel framing manufacturer who utilizes a qualified professional engineer to prepare design calculations, shop drawings, and other structural data for steel joists.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of member, accessory, and product indicated.
- B. Shop Drawings:
  - 1. Detail wall, floor joist, and roof framing layout.
  - 2. Indicate component details including openings, anchorage, welding, fasteners and accessories required to complete installation.
  - 3. Provide structural calculations signed and sealed by a professional engineer including loads and stresses for each component.
- C. Welding certificates.

- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
  - 1. Power-actuated mechanical fasteners.
  - 2. Screw fasteners.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel" and AWS D1.3, "Structural Welding Code - Sheet Steel."

## 1.6 DELIVERY, STORAGE, AND HANDLING.

- A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Protect materials from corrosion, deformation and other damage during delivery, storage and handling. Protect members from exposure to harmful weather conditions with a ventilated waterproof covering.

## PART 2 - PRODUCTS

### 2.1 COLD FORMED STEEL FRAMING

- A. Fabricate metal framing units from sheet steel conforming to ASTM A 1003.
  - 1. Finish: Galvanized, Class G60, minimum.
- B. Framing accessories: Fabricate from minimum 16 gauge steel sheet of the type and finish used for framing members. Provide manufacturer's standard configuration for the following accessories:
  - 1. Track channel
  - 2. Bridging
  - 3. Flat strapping

### 2.2 FASTENINGS

- A. Self-drilling, self-tapping screws, bolts, nuts, and washers, ASTM A 90
- B. Anchorage devices: Hot dipped galvanized or stainless steel, including:
  - 1. Powder actuated fasteners
  - 2. Power driven anchor screws
  - 3. Drilled expansion bolts
  - 4. Screws with sleeves
- C. Welding: Conform to the requirements of AWS D1.1.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

### 3.2 ERECTION

- A. Install cold formed steel framing and accessories according to the requirements of ASTM C 1007 except where exceeded by other requirements.
- B. Join components by welding, screws, or bolts as recommended by the framing component manufacturer for the members to be joined.
- C. Wall Systems:
  - 1. Erect framing and panels plumb, level and square in strict accordance with approved shop drawings.
  - 2. Handle and lift prefabricated panels in a manner so as not to cause distortion in any member.
  - 3. Anchor runner track securely to the supporting structure as shown on the erection drawings. Install concrete anchors only after full compressive strength has been achieved. Provide a sill sealer or gasket barrier between all concrete and steel connections.
  - 4. Butt all track joints. Securely anchor abutting pieces of track to a common structural element or butt-weld or splice them together.
  - 5. Align and plumb studs, and securely attach to the flanges or webs of both upper and lower tracks except when vertical movement is specified.
  - 6. Install jack studs or cripples below window sills, above window and door heads, at freestanding stair rails and elsewhere to furnish support, securely attached to supporting members.
  - 7. Attach wall stud bridging in a manner to prevent stud rotation. Space bridging rows according to manufacturer's recommendations with a maximum spacing of 4'-0".
  - 8. Frame wall openings to include headers and supporting studs as shown in the drawings.
  - 9. Provide temporary bracing until erection is completed.
  - 10. Provide braced walls at locations indicated on plans as "shear walls" for frame stability and lateral load resistance.
  - 11. As necessary provide for structural vertical movement using a vertical slide clip or other means in accordance with manufacturer's recommendations.

### 3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.

- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

#### 3.4 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings with galvanized repair paint according to ASTM A 780 and manufacturer's instructions.

END OF SECTION 054000



## SECTION 061000 - ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. This Section includes the following:

1. Wood blocking and nailers
2. Wood furring
3. Plywood backing panels

#### 1.2 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1. Include data for wood-preservative and fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.

C. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Wood-preservative-treated wood
2. Fire-retardant-treated wood
3. Power-driven fasteners
4. Powder-actuated fasteners
5. Expansion anchors
6. Metal framing anchors

#### 1.3 QUALITY ASSURANCE

A. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria":

1. Dimension lumber framing
2. Miscellaneous lumber

### PART 2 - PRODUCTS

#### 2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency

certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Provide dressed lumber, S4S, unless otherwise indicated.

## 2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPAC2, 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 containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat all rough carpentry, unless otherwise indicated.
  1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

## 2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Comply with performance requirements in AWPAC20 (lumber) and AWPAC27 (plywood).
  1. Use Exterior type for exterior locations and where indicated.
  2. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
  3. Use Interior Type A, unless otherwise indicated.
- B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Application: Treat all rough carpentry, unless otherwise indicated.
  1. Concealed blocking
  2. Plywood backing panels

## 2.4 DIMENSION LUMBER FRAMING

- A. Maximum Moisture Content: 19 percent

## 2.5 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking
  - 2. Nailers
  - 3. Furring
  - 4. Grounds
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.
- C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
  - 1. Mixed southern pine, No. 2 grade; SPIB
  - 2. Eastern softwoods, No. 2 Common grade; NeLMA
  - 3. Northern species, No. 2 Common grade; NLGA
  - 4. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA

## 2.6 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated

## 2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified.
  - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Power-Driven Fasteners: NES NER-272
- C. 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

## 2.8 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Alpine Engineered Products, Inc.
  - 2. Cleveland Steel Specialty Co.
  - 3. Harlen Metal Products, Inc.
  - 4. KC Metals Products, Inc.
  - 5. Simpson Strong-Tie Co., Inc.
  - 6. Southeastern Metals Manufacturing Co., Inc.
  - 7. USP Structural Connectors
- B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be

determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

- C. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

## 2.9 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- 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, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- D. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- E. Do not splice structural members between supports, unless otherwise indicated.
- F. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code
  - 3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code
  - 4. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code
  - 5. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code
  - 6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings
  - 7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code

### 3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000



## SECTION 066116 - SOLID SURFACING FABRICATIONS

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

A. Work described in this section:

1. Built-in countertops

B. Related work specified elsewhere:

1. Manufactured Casework - 123554

#### 1.02 REFERENCES

A. Applicable Standards: Standards of the following, as referenced herein:

1. American National Standards Institute (ANSI)
2. American Society for Testing and Materials (ASTM)
3. National Electrical Manufacturers Association (NEMA)
4. Federal Specifications (FS)

#### 1.03 SUBMITTALS

- A. Shop drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
- B. Samples: Submit minimum 2" x 2" samples. Indicate full range of color and pattern variation. Approved samples will be retained as standards for work.
- C. Product data: Indicate product description, fabrication information and compliance with specified performance requirements.
- D. Maintenance data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project close-out documents.

#### 1.04 QUALITY ASSURANCE

- A. Allowable tolerances:
  1. Variation in component size:  $\pm 1/8"$  (3 mm).
  2. Location of openings:  $\pm 1/8"$  (3 mm) from indicated location.

#### 1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver no components to project site until areas are ready for installation. Store components indoors prior to installation.
- B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

#### 1.06 WARRANTY

- A. Provide manufacturer's 10 year warranty against defects in materials. Warranty shall provide material and labor to repair or replace defective materials. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

### PART 2 - PRODUCTS

## 2.01 SOLID POLYMER FABRICATIONS

- A. Preferred products: 1. du Pont de Nemours & Co. Inc, Corian  
2. AYONITE  
3. SUREAL
- B. Material:  
Homogeneous filled acrylic; not coated, laminated or of composite construction; meeting ANSI Z124.3 & .6, Type Six, and Fed. Spec. WW-P-541E/GEN.  
1. Material shall have minimum physical and performance properties specified in the following Section U.  
2. Superficial damage to a depth of 0.010" (.25 mm) shall be repairable by sanding and polishing.
- C. Counter Top: [3/4" (19 mm)] thick solid polymer material, adhesively joined with inconspicuous seams; edge details as indicated on the Architect's Drawings; white color. [Technical Bulletin: 130].
- D. Performance characteristics:

PROPERTY	REQUIREMENT	TEST PROCEDURE
	(min or max)	
Tensile Strength	5000 psi min	ASTM D638
Tensile Modulus	$1.0 \times 10^5$ psi min	ASTM D638
Flexural Strength	7000 psi min	ASTM D790
Flexural Modulus	$1.0 \times 10^5$ psi min	ASTM D790
Elongation	0.3% min.	ASTM D638
Hardness	90-Rockwell "M" scale min. 52-Barcol Impresser min.	ASTM D758 ASTM D2583
Thermal Expansion	$3.5 \times 10^{-6}$ in/in/deg C. max. $1.95 \times 10^{-6}$ in/in/deg F. max.	ASTM D696
Color Stability	No change, 100 hours min.	NEMA LD3-3.10
Wear and Cleanability	Passes	ANSI Z124.3
Abrasion Resistance	No loss of pattern max. weight loss (1000cycles) =0.9g.	NEMA LD3-3.01      ANSI Z124.3
Boiling water Surface Resistance	No Change	NEMA LD3-3.05
High Temperature Resistance	No Change	NEMA LD3-3.06
Impact Resistance Notched Izod Gardner	0.24 ft.-lbs.min. 9.0 ft-lbs min.	ASTM D256, Method A ASTM D3029
Ball drop 1/4" sheet 1/2" sheet 3/4" sheet	36" min, 1/2 lb ball, no failure 140" min, 1/2 lb ball, no failure 200" min, 1/2 lb ball, no failure	NEMA LD3-303
Bowls (point impact)	No cracks or chips	ANSI Z124.3 and 124.6
Stain Resistance	Passes	ANSI Z124.3
Weatherability	No change,min. 1000 hours	ASTM D1499
Fungi and Bacteria	No Attack	ASTM G21, ASTM G22
Specific Gravity	1.6 min	



Water Absorption Weight (% max.)	24 hrs. 0.05 0.10	Long Term 0.50(1/4") 0.90(3/4")	ASTM D570
Flammability		ASTM E84	
		solid colors	
	1/4"	1/2"	3/4"
Flame spread	25 max	25 max	25 max
Smoke Developed	30 max	30 max	30 max
Class	1	1	1
		particulate patterns	
	1/4"	1/2"	3/4"
Flame spread	25 max	25 max	25 max
Smoke Developed	30 max	30 max	30 max
Class	1	1	1
Pittsburgh Protocol Toxicity (as used by NY State)	solids-80 gms minimum rating patterns-65 gms minimum		"LC50" Test

## 2.02 ACCESSORY PRODUCTS

- A. Joint adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints, with a chemical bond. (Technical Bulletin: CTDC 102)
- B. Sealant: Manufacturer's standard mildew-resistant, FDA/UL® recognized silicone sealant in color matching or clear formulations. (Technical Bulletin: 102, 127)

## 2.03 FABRICATION

- A. For warranty coverage, fabricator/installer shall be approved by solid polymer manufacturer.
- B. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and solid polymer manufacturer requirements.
- C. Provide holes and cutouts for plumbing and bath accessories as indicated on the drawings.
- D. Rout and finish component edges to a smooth, uniform finish. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.
- E. Finish: All surfaces shall have uniform finish.
  - 1. Matte, with a gloss rating of 5 - 20.

## PART 3 - EXECUTION

Mount Pleasant CSD/  
New Maintenance Building  
NYSED #66-08-01-06-3-012-001

066116-3

#4.1449.02

### 3.01 INSTALLATION

- A. Install components plumb and level, in accordance with approved shop drawings and product installation details.
- B. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.
- C. Adhere undermount/submount/bevel mount sinks/bowls to countertops using manufacturer's recommended adhesive and mounting hardware. [Technical Bulletin H-16307]
- D. Adhere topmount sinks/bowls to countertops using manufacturer recommended adhesives and color-matched silicone sealant.
- E. Provide backsplashes and endsplashes as indicated on the drawings. Adhere to countertops using manufacturer's standard color-matched silicone sealant.
- F. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Components shall be clean on Date of Substantial Completion.
- G. Make plumbing connections to sinks in accordance with Division 23. Mechanical.
- H. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged work that cannot be repaired to architect's satisfaction and invoice for the cost of repairs. Architect to pre-approve cost estimate before repairs are made.
- I. Fabricator/Installer is to provide a commercial care and maintenance video, review maintenance procedures and warranty details with the director of maintenance upon completion of project.

END OF SECTION 066116

## SECTION 072100 – 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

- A. This Section includes the following:
  - 1. Concealed building insulation.
  - 2. Spray Polyurethane Foam Insulation
  - 3. Vapor retarders.

#### 1.3 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.

#### 1.4 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. Fire-Resistance Ratings: ASTM E 119.
  - 3. Combustion Characteristics: ASTM E 136.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Glass-Fiber Insulation:
    - a. CertainTeed Corporation.
    - b. Johns Manville Corporation.
    - c. Knauf Fiber Glass.
    - d. Owens Corning.
  2. Vapor Retarders
    - a. Raven Industries, Inc.
    - b. Reef Industries, Inc.  
Architect Approved Equal.

### 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; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- C. Spray Polyurethane Foam Insulation: Two-component spray polyurethane cellular plastic foam. Complying with the following methods and meeting the following physical properties:
  1. Core Density (ASTM D1622): Min. 2 pcf
  2. Thermal Resistance (ASTM C518): 140 degree F/90 day aged R-value, measured at 75 F mean Temp: min R6.0/inch
  3. Flame Spread (ASTM E84, Class A): 25 or less
  4. Smoke Developed (ASTM E84, Class A): 450 or less
  5. Compressive Strength Minimum (ASTM D1621, 10% parallel to rise): (20 psi) (182 kPa)
  6. Closed Cell Content (ASTM D2856): minimum 95 percent
  7. Water Absorption by Volume Maximum (ASTM D2842): 2.5 percent
  8. Water Vapor Permeability maximum (ASTM E96): 2.5 perm – inch

## 2.3 VAPOR RETARDERS

- A. Products: Subject to compliance with requirements, provide one of the following:
1. Reinforced-Polyethylene Vapor Retarders:
    - a. Raven Industries, Inc.; DURA-SKRIM 2 - 6 MIL.
    - b. Reef Industries, Inc.; Griffolyn TX 1200 - 6 MIL.
  - B. Reinforced-Polyethylene Vapor Retarders: 2 outer layers of high-strength polyethylene film laminated to an inner reinforcing layer consisting of polyester scrim and weighing not less than 25 lb/1000 sq. ft., with maximum permeance rating per ASTM E96 procedure B.
  - C. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

## 2.4 INSULATION FASTENERS

- A. Products: Subject to compliance with requirements, provide one of the following:
1. Adhesively Attached, Spindle-Type Anchors:
    - a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
    - b. Eckel Industries of Canada Limited; Stic-Klip Type N Fasteners.
    - c. Gemco; Spindle Type.
  2. Insulation-Retaining Washers:
    - a. AGM Industries, Inc.; RC150.
    - b. AGM Industries, Inc.; SC150.
    - c. Gemco; Dome-Cap.
    - d. Gemco; R-150.
    - e. Gemco; S-150.
  3. Insulation Standoff:
    - a. Gemco; Clutch Clip.
  4. Anchor Adhesives:
    - a. AGM Industries, Inc.; TACTOO Adhesive.
    - b. Eckel Industries of Canada Limited; Stic-Klip Type S Adhesive.
    - c. Gemco; Tuff Bond Hanger Adhesive.
- B. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
1. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches (50 mm) square.
  2. Spindle: Copper-coated, low carbon steel, fully annealed, 0.105 inch in diameter, length to suit depth of insulation indicated.

- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
  - 1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
    - a. Ceiling plenums.
    - b. Attic spaces.
    - c. Where indicated.
- D. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of dimension indicated between face of insulation and substrate to which anchor is attached.
  - 1. Air Space: 1 inch (25 mm).
- E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

## 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 vapor retarders or of 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. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. 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 BLANKET 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. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
  - 1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- C. 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.
  - 3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

### 3.5 INSTALLATION OF INSULATION FOR SOUND ATTENUATION:

- A. Install 3 ½" unfaced Sound Attenuation Fire Batts / MW blanket insulation in stud wall cavities. 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 provide a snug fit between ends.

### 3.6 INSTALLATION OF SPRAY POLYURETHANE FOAM INSULATION

- A. Must be applied by manufacturer approved applicator.
- B. Apply SPF in accordance with ASTM C1029 and manufacturers installation guidelines.
- C. Apply spray foam in consecutive layers of not less than (1/2 inches) and not more than (2 inches) thick each to achieve total thickness required. For light-gauge steel and polystyrene board first layer should be a skim coat of 1/2" before adding extra layers.

### 3.7 INSTALLATION OF VAPOR RETARDERS

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.

- C. Seal overlapping joints in vapor retarders with adhesives or vapor-retarder tape according to vapor-retarder manufacturer's instructions. Seal butt joints and fastener penetrations with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
- D. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor-retarder manufacturer.
- E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- F. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

### 3.8 PROTECTION

- A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100



## SECTION 078443 - FIRESTOPPING

### PART 1 - GENERAL

- 1.1 Applicable provisions of the Conditions of the Contract and Division #1, General Requirements, govern work in this Section.

1.2 DESCRIPTION OF WORK

- A. The work of this Section consists of the provision of all materials, labor and equipment and the like necessary and/or required for the complete execution of all firestopping and smoke seal work for this project as required by the schedules, keynotes and drawings, including, but not limited to the following:

NOTE: Firestopping is defined as a material, or combination of materials, to restore the integrity of fire rated walls and floors by maintaining an effective barrier against the spread of flame, smoke and toxic gases and further defined in 1.4 below.

1. Provide firestopping and smoke seals as indicated on the drawings and/or required to maintain full and continuous smoke and fire barrier between zones including:
  - a. Through penetration firestops and smoke-stops for all fire-rated bearing and non-bearing wall and floor assemblies, both blank (empty) and those accommodating penetrating items such as cables, conduits, pipes, ducts, etc.

NOTE: A preinstallation conference shall be scheduled by the Contractor with this Specialty Contractor and all other Specialty Contractors, Subcontractors and the like to establish procedures to maintain optimum working conditions and to coordinate the work of this Section with related and adjacent work.

1.3 RELATED WORK SPECIFIED ELSEWHERE – Entire Project Specification

NOTE: Proper execution of this work will maintain the hourly ratings of the walls and floors and ensure progress of work in other Sections as listed below.

1.4 QUALITY ASSURANCE

- A. Firestopping systems (materials and design):
1. Shall conform to both Flame (F)P and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E 814 or UL 1479 fire tests in a configuration that is representative of field conditions.
  2. The F rating must be a minimum of 1 hour but not less than the fire resistance rating of the assembly being penetrated.
  3. T rating when required by code authority shall be based on measurement of the temperature rise on penetrating item(s).
  4. The fire test shall be conducted with a minimum positive pressure differential of 0.03 inches of water column.

5. For joints, must be tested to UL 2079 or E 1399 and E 1966 with movement capabilities equal to those of the anticipated conditions.
  6. Where there is no specific third party tested and classified firestop system available for a particular firestop configuration, the firestopping contractor shall obtain from the firestop manufacturer an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRR) for submittal.
- B. Firestopping materials and systems must be capable of closing or filling through-openings created by 1) the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials, or 2) deflection of sheet metal due to thermal expansion (electrical and mechanical duct work).
  - C. Firestopping sealants must be flexible, allowing for normal pipe movement.
  - D. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.
  - E. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.
  - F. For firestopping exposed to view, traffic, moisture, and physical damage, provide appropriate firestop systems for these conditions.
  - G. All firestopping materials shall be manufactured by one manufacturer (to the maximum extent possible).
  - H. Material used shall be in accordance with the manufacturer's written installation instructions.
  - I. Firestopping shall be performed by a Specialty Contractor trained or approved, in writing, by firestop material manufacturer. Said specialist shall be as defined in the Conditions. Equipment used shall be in accordance with firestop material manufacturer's written installation instructions.
  - J. Materials shall conform to all applicable governing codes.
  - K. All materials used in the work shall be certified "asbestos free" and shall be free from any and all solvents or components that require hazardous waste disposal or, that after curing, dissolve in water.
  - L. All materials shall comply with the interior finish flame spread and smoke developed requirements for the area in which they are installed./ Coordinate with governing codes.
  - M. DEFINITIONS
    1. FIRESTOPPING: The use of a material or combination of materials in a fire-rated structure (wall or floor) where it has been breached, so as to restore the integrity of the fire rating on the wall or floor.
    2. SYSTEM: The use of a specific firestop material or combination of materials in conjunction with a specific wall or floor construction type and a specific penetrant(s), constitutes a "system".
    3. BARRIER: Any bearing or non-bearing wall or floor that has an hourly fire and smoke rating.

4. THROUGH-PENETRATION: Any penetration of a fire-rated wall or floor that completely breaches the barrier.
5. MEMBRANE-PENETRATION: Any penetration in a fire-rated wall that breaches only one side of the barrier.
6. CONSTRUCTION GAPS: Any gap, joint, or opening, whether static or dynamic, where the top of a wall may meet a floor; wall to wall applications; edge to edge floor configurations; floor to exterior wall; or any linear breach in a rated barrier. Where movement is required, the firestopping system must comply with UL2079 for dynamic joints.

#### 1.5 SUBMITTALS

NOTE: A "Certificate of Conformance", from the manufacturer listed in Part 2, is required with the "Submittal Package" to ensure that the material selected meets all of the criteria of this specification as set forth in Paragraph 1.4 of this Section.

- A. Submit manufacturer's product literature for each type of firestop material to be installed. Literature shall indicate project characteristics, typical uses, performance and limitation criteria, and test data. Submittal should be in compliance with Section 013300.
- B. UL Tested Systems: Submit drawings showing typical installation details for the methods of installation. Indicate which firestop materials will be used and thickness for different hourly ratings.
- C. Engineering Judgments: Submit manufacturer's drawings for all non-standard applications where no UL tested system exists. All drawings must indicate the "Tested" UL system upon which the judgment is based so as to assess the relevance of the judgment to some known performance.
- D. Submit manufacturer's installation procedures for each type of product.
- E. Approved Applicator: Submit document from manufacturer where in manufacturer recognizes the installer as a qualified or submit a list of past projects to demonstrate capability to perform intended work.
- F. Upon completion, installer shall provide written certification that materials were installed in accordance with the manufacturer's installation instructions and details.
- G. Mockups:
  1. Prepare job mockup of the material proposed for use in the project as directed by Architect. Approved mockups shall be left in place as part of the finished project and will constitute the standard for remaining work, including aesthetics.
- H. Manufacturers Material Safety Data Sheet (MSDS) must be submitted for each manufactured product.

#### 1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver all materials to be used in the work of this section to the project site in original sealed containers with manufacturer's brand and name, lot numbers, UL labeling, mixing and installation instructions clearly identified thereon.
- B. Store all materials in accordance with manufacturer's directions from the project site at the contractors expense if date is expired.

#### 1.7 REFERENCE STANDARDS

##### A. American Society for Testing and Materials (ASTM)

- 1. E 814 – Standard Method of Fire Tests of Through Penetration Fire Stops.
- 2. E 119 – Methods of Fire Tests of Building Construction and Materials.
- 3. E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- 4. E 136 – Test Method for Behavior of Materials in a Vertical Tube Furnace at 750F.
- 5. E 1399 – Cyclic Movement and Measuring Minimum and Maximum Joint Widths.
- 6. E 1966 – Test Method for Resistance of Building Joint.
- 7. E 2174 – Standard Practice for On-Site Inspection of Installed Fire Stops.
- 8. E 05.11.14 – Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using the Intermediate-Scale, Multi Story Test Apparatus (ISMA); ASTM permanent number assignment pending approval of Draft.

##### B. Underwriters Laboratories, Inc. (UL)

- 1. UL 1479 – Fire Tests of Through Penetration Fire Stops.
- 2. UL 263 – Fire Tests of Building Construction and Materials.
- 3. UL 723 – Surface Burning Characteristics of Building Materials.
- 4. UL 2079 – Tests for Fire Resistance of Building Joint Systems.
- 5. UL "Fire Resistance Directory", current year, including but not limited to the following:
  - a. For penetrations by uninsulated, non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT) – UL System: CAJ1235, CAJ1404, WL1152.
  - b. For penetrations by insulated, non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EAMT) – UL System: CAJ5222, CAJ5250, CAJ5251, WL5171.

- c. For penetrations by PVC jacketed, flexible cable or cable bundles and plastic pipe (closed piping systems) – UL System: CAJU2401, CAJ3185, CAJ3199, CAJ3234, WL3118, WL3179, WL3199.
  - d. For penetrations by combustible plastic pipe (open piping systems) – UL System: CAJ2174, CAJ2339, CAJ2351, CAJ2432, WL2168, WL2170, WL2185, WL2259.
  - e. For penetrations by multiple combustible and/or non-combustible items – UL System: CAJ8101, CAJ8133, WL8007.
  - f. For large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways – UL System: CAJ1406, CAJ1502, CAJ4053, CAJ6027, WJ6004, WL1207, WL1343, WL4030, WL6018.
  - g. For penetrations by steel ducts – UL System: CAJ7075, CAJ7082, WJ7045, WL7046, WL7006, WL7046, WL7081, WL7082.
  - h. For fire-rated construction joints and other gaps – OPL System: CEJ296P, CEJ302P.
6. For openings between structurally separate sections of wall and floors. At the top of walls – UL System: HWD0107, HWD0110, HWD0257, HWD0267, HWD0299, HWD0327, HWD0266, HWD 0333, HWD0334.
- C. Factory Mutual (FM) Approval Guide, current year.
- 1. FM Approval Standard of Firestop Contractors – Class 4991.
- D. Building code of the jurisdiction of the Work.
- E. National Fire Protection Association
- 1. NFPA 101 – Life Safety Code.
  - 2. NFPA 70 – National Electrical Code.
  - 3. NFPA 221 – Fire Walls and Fire Barriers (preliminary to be released).
  - 4. NFPA 251 – Fire Tests of Building Construction and Materials
- F. FICA “Manual of Practice”.
- G. Certification of “DRI” employee(s).
- H. International Firestop Council (IFC):
- 1. Ref. 1 Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments (April 2001)

## 2. Ref. 2 Inspectors Field Pocket Guide

### 1.8 PROJECT CONDITIONS

- A. Conform to manufacturer's printed instructions for installation and when applicable, curing in accordance with temperature and humidity. Conform to ventilation and safety requirements.
- B. Coordinate work required with work of other trades; firestopping shall, where practical, precede gypsum board or other applied sheet finishing operations.
- C. Where firestopping is installed at locations which will remain exposed in the finished work, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and protect as required against damage from other construction operations.

### 1.9 SEQUENCING

- A. Schedule firestopping after installation of penetrants but prior to concealing the openings.

### 1.10 PROTECTION

- A. Where firestopping is installed at locations which will remain exposed in the completed work, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and protect as necessary against damage from other construction activities.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Firestopping materials and systems shall meet the requirements specified herein.
- B. Architect must approve in writing any alternates to the materials and systems specified herein.
- C. All firestop products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.
- D. For applications where combustible penetrants are involved, i.e., insulated and plastic pipe, a suitable intumescent material must be used.

### 2.2 SPECIFIED STANDARD: For purposes of establishing standards of quality and levels of performance and not for the purposes of limiting competition, the basis of this specification is upon units as manufactured by one of the following and their respective model suitable for the intended application.

- A. Hilti, Inc.
- B. Specified Technologies, Inc.
- C. Grace / IPC Corp.

- D. Nelson Firestop Products
- E. Tremco, Inc.
- F. U.S. Gypsum Company
- G. Johns Manville

2.3 PRODUCTS SHALL GENERALLY INCLUDE:

- A. Cast-In-Sleeves (3M CID).
- B. Mortar seals.
- C. Fire stop design sealant compounds, caulk and foam systems.
- D. Putty and putty pads.
- E. Firestop kits including collars, plugs, etc.
- F. Seal bags.
- G. Tapes and blankets.
- H. Intumescent design wrap strips.
- I. Mineral type unfaced safing insulation with third party wrap, 3.5 pcf density, UL R-10905 label.

2.4 ACCESSORY ELEMENTS

- A. Forming, damming materials shall be mineral fiber board or other suitable material recommended by nominated system manufacturer.
- B. Primers, sealant and solvent cleaners shall be as recommended by the nominated system manufacturer.
- C. Metal Systems – 20 gauge phosphatized, electro-galvanized steel plate and/or galvanized steel clips.

2.5 Balance of materials shall be as specified elsewhere in this Section.

PART 3 – EXECUTION

3.1 INSPECTION AND ACCEPTANCE

- A. Examine all surfaces and contiguous elements to receive work of this section and correct, as part of the Work of this Contract, any defects affecting installation. Commencement of work will be construed as complete acceptability of surfaces and contiguous elements.
- B. Verify the environmental conditions are safe and suitable for installation of firestop products./

- C. Verify that all pipe, conduit, cable, and other items which penetrate fire-rated construction have been permanently installed prior to installation of firestops.

### 3.2 PREPARATION

- A. The surface shall be dry, clean, and free of all foreign matter. Do not apply firestopping to surfaces previously painted or treated with a sealer, curing compound, water repellent or other coatings unless tests have been performed to ensure compatibility of materials.
- B. Provide primers as required which conform to manufacturer's recommendations for various substrates and conditions.
- C. Mask where necessary to protect adjoining surfaces.
- D. Remove excess material and stains on surfaces as required.

### 3.3 INSTALLATION – GENERAL SYSTEMS

- A. Install in strict accordance with manufacturer's printed instructions as well as UL guidelines and state and local fire codes.
- B. Ensure that anchoring devices, backup materials, clips, sleeves, supports and other materials used in the actual fire test are installed.
- C. Install firestopping with sufficient pressure to properly fill and seal openings to ensure an effective smoke seal.
- D. Tool or trowel exposed surfaces. Remove excess firestop material promptly as work progresses and upon completion.
- E. Install dams when required to properly contain firestopping materials within openings and as required to achieve required fire resistance ratings. Combustible damming materials must be removed after appropriate curing. Incombustible damming materials may be left as a permanent component of the firestopping system.

### 3.4 PENETRATION SEALS

- A. Penetrations are defined as conduits, cables, wires, piping, ducts or other elements passing through one or both outer surfaces of fire rated walls, floors or partitions and shall be firestopped on both sides of penetration in accordance with requirements set forth in Paragraph 1.4 of this Section.
- B. Where sleeves are used, same shall be as specified in Part 2 herein; in event that sleeves are not used, core openings and caulk or wrap penetrating items with intumescent system the full length of penetration and seal on both sides with intumescent caulk. Residual openings within square or rectangular holes shall be filled with compounds applicable for substrate encountered and all penetrations sealed on both sides with caulk.

### 3.5 FIELD QUALITY CONTROL



- A. Contractor shall immediately notify the Architect if the firestopping systems herein specified cannot meet the requirements of the specification.
- B. Contractor shall examine firestops to ensure proper installation and full compliance with this specification.
- C. All areas of work must be accessible until inspection by the applicable Code authorities.
- D. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification at no additional cost.

### 3.6 IDENTIFICATION

- A. Identify firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
  - 1. The words: "Warning—Firestop System—Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's name, address, and phone number.
  - 3. Firestop system designation of applicable testing and inspecting agency.
  - 4. Date of installation.
  - 5. Firestop system manufacturer's name.
  - 6. Installer's name.

### 3.7 CLEANING

- A. When finished work will be visible, clean adjacent surfaces in accordance with manufacturer's printed instructions.
- B. If visible in the finished work, remove temporary dams after initial cure of firestops.
- C. Correct staining and discoloring on adjacent surfaces.
- D. Remove all debris and excess materials entirely from site and leave work in a neat and clean condition.

### 3.8 FIRESTOP SYSTEM SCHEDULE

- A. The following schedules shall be completed by the Contractor and reviewed prior to submission to the Architect. The untitled table included shall be completed with each of the following categories of penetrating items.
  - 1. Single uninsulated metallic piping and conduit.
  - 2. Multiple uninsulated metallic piping and conduit.

3. Uninsulated plastic piping and conduit.
  4. Insulated metallic piping.
  5. Electrical cable.
  6. Bus duct.
  7. Miscellaneous penetrations.
- B. Complete the additional tables for the following using the format provided.
1. Blanks, voids, holes.
  2. Engineering judgments.
  3. Ductwork engineering judgments.

### 3.09 WASTE MANAGEMENT

- A. Separate and recycle materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
- B. Set aside and protect materials suitable for reuse and/or remanufacturing.
- C. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

#### **PENETRATING ITEM:**

Manufacturer/Product Name:

Color:

Accessories:

Floor/Wall Construction	Item Size/Description	Sleeve	F Rating	T Rating	Annular Space	Firestop Thickness	Tested Ass'y No.


**BLANKS, VOIDS, HOLES:**

Manufacturer/Product Name:

Color:

Accessories:

Floor/Wall Construction	Size/ Description	F Rating	T Rating	Firestop Thickness	Tested Ass'y No.

**ENGINEERING JUDGMENTS (Submit Actual Installation Drawing and Letter of Certification)**

Manufacturer/Product Name:

Color:

Accessories:

Floor/Wall Construction	Item/Size Description	F Rating	T Rating	Annular Space	Firestop Thickness	Packing Thickness

**DUCTWORK ENGINEERING JUDGMENTS** (Submit Actual Installation Drawing and Letter of Certification)

Manufacturer/Product Name:

Color:

Accessories:

Wall/FI Construction	Size	Fire Damper	F	T	Annular Space Range	Firestop Thickness	Packing Thickness

END SECTION 078443

## SECTION 079200 - JOINT SEALANTS

### PART 1 - GENERAL

#### 1.01 SUMMARY

##### A. Section Includes:

1. The sealing of joints indicated on schedule at the end of this section.
  2. The sealing of exterior joints, including:
    - a. Coping joints
    - b. Joints around perimeter of frames
  3. The sealing of interior joints, including:
    - a. Wall joints
    - b. Joints around perimeter of frames
    - c. Joints between countertops and walls
  4. The sealing of concealed joints in sound-retardant assemblies, including:
    - a. Around all electric outlet boxes, between top and bottom stud runners and structure, and where indicated
  5. The sealing of joints in floors and pedestrian paving
  6. The sealing of penetrations through exterior walls and roofs by pipes, ducts and conduit
  7. The sealing of other joints indicated on drawings
- B. Joints of a nature similar to that of joints indicated on the schedule shall be sealed with same sealer, whether indicated on drawings to be sealed or not.
- C. Related Sections:
1. Joint sealers in plumbing work: Division 22
  2. Joint sealers in mechanical work: Division 23

#### 1.02 REFERENCES

- A. AAMA 800-92 -- Voluntary Specifications and Test Methods for Sealants; American Architectural Manufacturers Association; 1992.
- B. ASTM C 719-93 -- Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle); 1993.
- C. ASTM C 834-95 -- Standard Specification for Latex Sealants; 1995.
- D. ASTM C 919-84(88) -- Standard Practice for Use of Sealants in Acoustical Applications; 1984 (Reapproved 1988).

- E. ASTM C 920-95 -- Standard Specification for Elastomeric Joint Sealants; 1995.
- F. ASTM C 1193-91 -- Standard Guide for Use of Joint Sealants; 1991.
- G. ASTM D 2628-91 -- Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements; 1991.
- H. FS A-A-272 -- Caulking Compounds; 1980.

#### 1.03 SUBMITTALS

- A. Product Data: Manufacturer's data on each joint sealer, with instructions for substrate preparation and installation.
- B. Samples for Color Selection: Cured samples of actual products showing manufacturer's full range of colors (Products exposed to view only.)
- C. Samples for Color Verification: Cured samples of each color of each product used, prepared to simulate actual joints minimum 6 inches long; use substrates similar appearance to actual substrates. (Products exposed to view only.)
- D. Substrate Test Report for Each Sealer.
- E. Certified Product Test Reports: Independent testing agency reports showing compliance with all specified requirements.
  - 1. Reports may be on tests conducted up to 24 months before submission, provided the products tested were aged specimens of the same formulation as that to be used.
- F. Field Installation Test Reports.
- G. Certificates: For each sealer, provide manufacturer's certificate stating that the product complies with the specifications and is appropriate for the use it is being put to.
- H. Installer's Preconstruction Inspection Report: List all conditions detrimental to performance of joint sealer work.

#### 1.04 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Execution of at least 50 sealer installations of similar size and scope.
  - 2. Similar installations completed within 5 years before start of this project.
  - 3. Lead mechanic assigned from among those experienced on previous similar projects.
- B. Substrate Tests: Have samples of actual substrate materials tested by manufacturer(s) of sealer products.
  - 1. Test to determine what preparation procedures (if any are necessary to make sealers adhere properly under environmental conditions that may occur during installation.
  - 2. Test to determine compatibility with substrates backers, and secondary seals, if any.
  - 3. Use manufacturer's standard test methods.
  - 4. Report the sealer manufacturer's recommendations for substrate preparation and sealer installation and identify specific primer(s) required.

5. The requirement for testing for this project will be waived if test reports based on previous testing of the products and substrates to be used are acceptable to the architect.

C. Field Installation Tests: Before installation, test the adhesion of all sealers to actual substrates.

1. Seal at least 5-foot lengths of joints and cure properly. Try to pull sealer out of joint by hand, by method recommended by sealer manufacturer.
2. Select test joints representative of joints to be sealed by the product to be tested.
3. Perform tests for each type of sealer.
4. Do tests in the presence of the architect.
5. Report acceptable results only.

D. Preinstallation Meeting: Have the installer, sealer manufacturers' representatives, and other affected installers meet to review sealer installation and protection procedures and sequencing with other work.

## 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original containers or bundles with labels showing manufacturer, product name or designation, color, shelf life, and installation instructions.

## 1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install sealers if any of the following conditions exist:

1. Air or substrate temperatures exceed the range recommended by sealer manufacturer or is below 40 degrees F (4.4 degrees C).
2. Substrate is wet, damp, or covered with snow, ice, or frost.

- B. Dimensional Limitations: Do not install sealers if joint dimensions are less than or greater than that recommended by sealer manufacturer; notify the architect and get sealer manufacturer's recommendations for alternative procedures.

- C. Coordination Data: Compression gasket manufacturer's requirements for joint dimensional tolerances; provide to installers of joints to be sealed with compression gaskets.

## 1.07 WARRANTY

- A. Submit written warranty signed by contractor and installer guaranteeing to correct failures in sealer work that occur within 5 years after substantial completion, without reducing or otherwise limiting any other rights to correction which the owner may have under the contract documents. Failure is defined as failure to remain weathertight due to faulty materials or workmanship. Correction is limited to replacement of sealers.

## PART 2 - PRODUCTS

### 2.01 MATERIALS - GENERAL

- A. General: Provide only products which are recommended and approved by their manufacturer for the specific use to which they are put and which comply with all requirements of the contract documents.
1. For each generic product, use only materials from one manufacturer.
  2. Provide only materials, which are compatible with each other and with joint substrates.
  3. Colors of exposed sealers: As selected by the architect from manufacturer's standard colors.
- B. Manufacturers: Products of the manufacturers listed, provided they comply with requirements of the contract documents will be among those considered acceptable.
1. Polysulfide sealants:
    - a. A. C. Horn, Inc.
    - b. W. R. Meadows, Inc.
    - c. Pecora Corporation
    - d. Products Research & Chemical Corporation
  2. Silicone sealants:
    - a. Bostik Inc.
    - b. Dow Corning Corporation
    - c. Pecora Corporation
    - d. Tremco, Inc.
    - e. GE Silicones
    - f. Rhone-Poulenc, Inc.
  3. Urethane sealants:
    - a. Bostik Inc.
    - b. Mameco International, Inc.
    - c. Pecora Corporation.
    - d. Products Research & Chemical Corporation.
    - e. Sika Corporation.
    - f. Sonneborn Building Products Division/ChemRex, Inc.
    - g. Tremco, Inc.
    - h. W. R. Meadows, Inc.
  4. Acrylic solvent-release sealants:
    - a. Pecora Corporation
    - b. Koch Protective Treatments, Inc.
    - c. Tremco, Inc.
  5. Butyl sealants:
    - a. Pecora Corporation
    - b. Koch Protective Treatments, Inc.
    - c. Tremco, Inc.
  6. Acrylic-latex emulsion sealant:
    - a. Bostik Inc.
    - b. Pecora Corporation
    - c. Sonneborn Building Products Division/ChemRex, Inc.



## 2.02 ELASTOMERIC SEALANTS

- A. Elastomeric Sealants - General: Chemically curing elastomeric sealants of types indicated, complying with ASTM C 920, including specific Type, Grade, Class, and Uses indicated, as well as all other requirements specified.
1. Where movement capability exceeding that measured by ASTM C 920 is specified, sealant shall withstand the total movement indicated while remaining in compliance with the other requirements specified, when tested in accordance with ASTM C 719, with base joint width measured at the time of application.
  2. For M-type substrates: Comply with requirements for Use M.
  3. For G-type substrates: Comply with requirements for Use G.
  4. For A-type substrates: Comply with requirements for Use A.
  5. For O-type substrates: Comply with requirements Use M (minimum) and Use O for the particular substrate.
- B. Two-Part Pourable Polysulfide Sealant: Type M, Grade P, Class 12-1/2, Use T.
- C. Polysulfide Sealant for Water Immersion: Type M, Grade NS, Class 12-1/2, Use T, specifically recommended by the manufacturer for sealing joints immersed continuously in water.
- D. One-Part Non-sag Polysulfide Sealant: Type S, Grade NS, Class 12-1/2, Use NT.
- E. High Movement Silicone Sealant: One- or two-part non-acid-curing, Grade NS, Class 25, Use NT, plus movement capability of at least 50 percent in both extension and compression.
- F. Medium Movement Silicone Sealant: One- or two-part non-acid-curing, Grade NS, Class 25, Use NT, plus movement capability of more than 25 percent but less than 50 percent in both extension and compression.
- G. High Strength Silicone Sealant: One-part, acid- or non-acid-curing, Type S, Grade NS, Class 25, Use NT; with not over plus or minus 30 percent movement capability.
- H. Mildew-Resistant Silicone Sealant: One-part, Type S, Grade NS, Class 25, Use NT, formulated with fungicide, for interior use on nonporous substrates.
- I. Silicone Sealant for Use T: One-part, non-acid curing, Type S, Grade NS, Class 25, Use T, Use M, plus movement capability of 50 percent in both extension and compression.
- J. All-Purpose Urethane Sealant: Multipart, non-sag, Type M, Grade NS, Class 25, Uses NT, M, G and A.
- K. Multipart Pourable Urethane Sealant: Type M, Grade P, Class 25, Use T.
- L. Non-sag Urethane Sealant for Use T: Type S or M, Grade NS, Class 25, Use T.
- M. One-Part Pourable Urethane Sealant: Type S, Grade P, Class 25, Use T.
- N. Urethane Sealant for Water Immersion: One- or two-part urethane, Grade NS, Class 25, Use NT, specifically recommended by the manufacturer for sealing joints immersed continuously in water.

## 2.03 SOLVENT-RELEASE-CURING SEALANTS

- A. Acrylic Sealant: Non-sag, one-part, solvent-release-curing; complying with ASTM C 920, Type S Grade NS, Use NT, with the following exceptions:
  - 1. Weight loss: 15 percent, maximum.
  - 2. Movement capability: 12-1/2 percent in both extension and compression, minimum.
- B. Butyl Sealant: Non-sag, one part, solvent-release-curing; complying with FS A-A-272, Type III; non-staining; paintable.

#### 2.04 LATEX SEALANTS

- A. Acrylic-Latex Emulsion Sealant: One-part, non-sag, mildew-resistant, paintable; complying with ASTM C 834.

#### 2.05 NON-CURING SEALERS

- A. Non-curing Butyl Sealant: Nondrying, non-hardening, non-skinning, non-staining, gunnable, synthetic rubber sealant.
- B. Butyl Polyisobutylene Sealant: Non-curing, nondrying, solvent-release; complying with 809.2, as described in AAMA 800.

#### 2.06 COMPRESSION SEALS

- A. Compression Gaskets: Neoprene (polychloroprene) hollow gasket; complying with ASTM D 2628; sizes and shapes as indicated.
  - 1. Accordion Type
  - 2. Manufacturers:
    - a. The D. S. Brown Company.
    - b. Watson Bowman Acme Corp.

#### 2.07 SEALANT BACKERS

- A. Backers - General: Non-staining; recommended or approved by sealant manufacturer for specific use.
- B. Backer Rods: Flexible, nonabsorbent, compressible polyurethane foam, either open-cell or non-gassing closed-cell, unless otherwise restricted by sealant manufacturer; preformed to appropriate size and shape.

#### 2.08 MISCELLANEOUS MATERIALS

- A. Primers: Use primers determined to be required by substrate tests.
- B. Cleaners: As recommended by sealer manufacturer and not damaging to substrates.
- C. Masking Tape: Nonabsorbent, non-staining.
- D. Tooling Agents: Approved by sealant manufacturer; non-staining to sealant and substrate.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine joints for characteristics that may affect sealer performance, including configuration and dimensions.
- B. For compression gaskets, joints should have straight, parallel sides within proper tolerances, free of spalls.
- C. Do not begin joint sealer work until unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Cleaning: Just before starting sealer installation, clean out joints in accord with recommendations of sealer manufacturers and as follows:
  - 1. Remove all material that could impair adhesion, including dust, dirt, coatings, paint, oil, and grease. Exception: Materials tested to show acceptable adhesion and compatibility.
  - 2. Dry out damp and wet substrates thoroughly.
  - 3. Clean M-type and O-type substrates by suitable mechanical or chemical methods.
  - 4. Remove loose particles by vacuuming or by blowing with oil-free compressed air.
  - 5. Concrete: Remove laitance and form-release coatings.
  - 6. Clean A-type and G-type substrates by chemical or other methods, which will not damage the substrate.
  - 7. Use methods, which will not leave residues that will impair adhesion.
- B. Priming: Prime substrates as recommended by sealer manufacturer.
- C. Masking Tape: Use masking tape to keep primers and sealers off of adjacent surfaces, which would be damaged by contact or by cleanup. Remove tape as soon as practical.
- D. Install fillers where needed to provide proper joint depth or support for sealant backers.

### 3.03 INSTALLATION

- A. Comply with sealer manufacturers' instructions and recommendations, except where more restrictive requirements are specified.
- B. Gunnable and Pourable Sealants: Comply with recommendations of ASTM C 1193.
- C. Sealants in Acoustical Assemblies: Comply with recommendations of ASTM C 919.
- D. Backers:
  - 1. Install backers at depth required to result in shape and depth of installed sealant, which allows the most joint movement without failure.
    - a. Make backers continuous, without gaps, tears, or punctures.
    - b. Do not stretch or twist backers.

2. If backers become wet or damp before installation of sealant, dry out thoroughly before proceeding.
- E. Sealants: Use methods recommended by manufacturer completely fill the joint; make full contact with bond surfaces; tool non-sag sealants to smooth surface eliminating air pockets.
  1. Use concave joint shape shown in Figure 5A in ASTM C 1193, where not otherwise indicated.
- F. Compression Gaskets: Use methods recommended by manufacturer; use as few end joints as possible; apply adhesive just before installing gaskets; make adhesively sealed joints at ends, corners, and intersections; install with top face approximately 1/8 to 1/4 inch below adjoining surfaces.

### 3.04 PROTECTION AND CLEANING

- A. Clean surfaces adjacent to joints as work progresses and before sealants set using methods and materials approved by manufacturers of sealers and of surfaces to be cleaned.
- B. Protect joint sealers from contamination and damage.
- C. Remove and replace damaged sealers.

### 3.05 SCHEDULE OF JOINT SEALERS

- A. General: Unless otherwise indicated, joints around perimeter of frames, where indicated to be sealed, are to be sealed using sealer specified for the substrate adjacent to the frame.
- B. Exterior Joints for Which No Other Sealer Is Indicated:
  1. Use one of the following sealants:
    - a. High movement silicone sealant
    - b. Medium movement silicone sealant
  2. Backer: Backer rod
  3. Joint shape: Concave joint configuration
- C. Interior Joints for Which No Other Sealer Is Indicated:
  1. Use one of the following sealants:
    - a. Acrylic-emulsion latex sealant
  2. Backer: Backer rod
  3. Joint shape: Concave joint configuration
- D. Below-Grade Joints:
  1. Use one of the following sealants:
    - a. Polysulfide sealant for water immersion
    - b. Urethane sealant for water immersion

2. Backer: Backer rod
  3. Joint shape: Concave joint configuration
- E. Exterior Joints Well Protected from Weather and Not Subject to Movement:
1. Use one of the following sealants:
    - a. Acrylic sealant
    - b. Butyl sealant
  2. Backer: Backer rod
- F. Interior Floor Joints and Pedestrian Paving Joints, Less than 1-1/2 Percent Slope:
1. Use one of the following sealants:
    - a. Compression gasket
    - b. Two-part pourable polysulfide sealant
    - c. Silicone sealant for Use T
    - d. Two-part pourable urethane sealant
    - e. Two-part nonsag urethane sealant for Use T
    - f. One-part pourable urethane sealant
  2. Backer: Backer rod
  3. Joint shape: Concave joint configuration
- G. Joints around Pipes, Ducts, and Conduit Penetrating Exterior Walls and Roofs:
1. Use one of the following sealants:
    - a. Same as used for adjacent substrates
- H. Joints in Interior Wet Areas:
1. Use one of the following sealants:
    - a. Mildew-resistant silicone sealant
  2. Backer: Backer rod
  3. Joint shape: Concave joint configuration
- I. Concealed Joints in Acoustical Assemblies:
1. Use one of the following sealants:
    - a. Acrylic-emulsion latex sealant
    - b. Non-curing butyl sealant
    - c. Butyl polyisobutylene sealant

END OF SECTION 079200



## SECTION 081113 – HOLLOW METAL 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 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Standard and custom hollow metal doors and frames.
  - 2. Steel sidelight, borrowed lite and transom frames.
  - 3. Louvers installed in hollow metal doors.
  - 4. Light frames and glazing installed in hollow metal doors.

- B. Related Sections:

- 1. Division 08 Section "Glass and Glazing" for glass view panels in hollow metal doors.
  - 2. Division 08 Section "Door Hardware".
  - 3. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
  - 4. Division 26 "Electrical" Sections for electrical connections including conduit and wiring for door controls and operators installed on frames with factory installed electrical knock out boxes.

- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

- 1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
  - 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
  - 3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
  - 4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
  - 5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
  - 6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
  - 7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
  - 9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
  - 10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
  - 11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
  - 12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
  - 13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.

14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
  1. Elevations of each door design.
  2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
  3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  4. Locations of reinforcement and preparations for hardware.
  5. Details of anchorages, joints, field splices, and connections.
  6. Details of accessories.
  7. Details of moldings, removable stops, and glazing.
  8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
  1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
  1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
  2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
  3. Smoke Control Door Assemblies: Comply with NFPA 105.



- a. Smoke "S" Label: Doors to bear "S" label and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Energy Efficient Exterior Openings: Comply with minimum thermal ratings, based on ASTM C1363. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.
  - 1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:
    - a. Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.29, R-Value 3.4, including insulated door, thermal-break frame and threshold.
  - 2. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements:
    - a. Rate of leakage of the door assembly shall not exceed 0.25 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).
- F. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
  - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

#### 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

## 1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
  - 1. CECO Door Products (C).
  - 2. Curries Company (CU).
  - 3. Pioneer Industries (PI).

### 2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

### 2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, and ANSI/SDI A250.4 for physical performance level.
  - 1. Design: Flush panel.
  - 2. Core Construction: Foamed in place polyurethane and steel reinforced core with no stiffener face welds.

- a. Provide 18 gauge steel vertical reinforcements 6 inches apart and welded in place. Foamed in place polyurethane core is chemically bonded to all interior surfaces. No face welding is permitted.
    - b. Thermal properties to rate at a fully operable minimum U-Factor 0.374 and R-Value 2.53, including insulated door, Mercury thermal-break frame and threshold.
    - c. Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.378 and R-Value 2.5, including insulated door, kerf type frame, and threshold.
  3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
  4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
  5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
  6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
  7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
  2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
    - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
  3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
  4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
  5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
  6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

## 2.4 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16" positive thermal break and integral vinyl weatherstripping.

- C. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
  - 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
  - 2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
- D. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
  - 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
  - 2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
- E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

## 2.5 FRAME ANCHORS

- A. Jamb Anchors:
  - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
  - 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
  - 3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

## 2.6 LOUVERS

- A. Metal Louvers: Unless otherwise indicated provide louvers to meet the following requirements.
  - 1. Blade Type: Vision proof inverted V or inverted Y.
  - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.
- B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.
  - 1. Manufacturers: Subject to compliance with requirements, provide louvers to meet rating indicated.
  - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

## 2.7 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

## 2.8 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

## 2.9 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
  - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
  - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
  - 3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
  - 4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
- D. Hollow Metal Frames:
  - 1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
  - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
3. Knocked Down Frames: Provide frames with locking corner tabs which permit field assembly. Factory install compression type anchors and countersunk screw holes to secure the bottom of the jambs.
4. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
5. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
6. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
7. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
8. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
9. Electrical Knock Out Boxes: Factory weld 18 gauge electrical knock out boxes to frame for electrical hardware preps; including but not limited to, electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
  - a. Provide electrical knock out boxes with a dual 1/2-inch and 3/4-inch knockouts.
  - b. Conduit to be coordinated and installed in the field (Division 26) from middle hinge box and strike box to door position box.
  - c. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Section "Door Hardware".
  - d. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
10. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
11. Jamb Anchors: Provide number and spacing of anchors as follows:
  - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
    - 1) Two anchors per jamb up to 60 inches high.
    - 2) Three anchors per jamb from 60 to 90 inches high.
    - 3) Four anchors per jamb from 90 to 120 inches high.
    - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
  - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
    - 1) Three anchors per jamb up to 60 inches high.
    - 2) Four anchors per jamb from 60 to 90 inches high.

- 3) Five anchors per jamb from 90 to 96 inches high.
  - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
  - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
12. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
  13. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
  2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
  3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
  4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

## 2.10 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

## 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 the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
  - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
  - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
  - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
  - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
  - 1. Non-Fire-Rated Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
  - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glass and Glazing" and with hollow metal manufacturer's written instructions.



### 3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 081113



## SECTION 083113 - ACCESS DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Flush access doors and frames for plumbing chase walls.
- B. Recessed drywall panel access doors for ceilings.

#### 1.02 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each door face material in specified finish.
- D. Schedule: Types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

#### 1.03 QUALITY ASSURANCE

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. UL 10B for vertical access doors and frames.

#### 1.04 COORDINATION

- A. If retaining this Article, also retain "Schedule" Paragraph in "Submittals" Article.
- B. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

### PART 2 - PRODUCTS

#### 2.01 STEEL MATERIALS

- A. Manufacturer's standard finish – No. 4 Stainless Steel Satin Finish.

## 2.02 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Acudor Products, Inc.
  - 2. Babcock-Davis; A Cierra Products Co.
  - 3. Karp Associates, Inc.
  - 4. Larsen's Manufacturing Company.
  - 5. MIFAB, Inc.
- C. Flush Access Doors and Frames with Exposed Trim: Fabricated from metallic-coated steel sheet.
  - 1. Locations: Plumbing chase walls.
  - 2. Door: Minimum 14 gage thick sheet metal.
  - 3. Frame: Minimum 16 gage.
  - 4. Hinges: Continuous concealed hinge.
  - 5. Latch: Stainless steel screwdriver operated cam latch.
  - 6. Lock: Cylinder.
  - 7. Basis of Design: Acudor UF-5000 10" x 10".
- D. Recessed 5/8" Drywall panel access door
  - 1. Locations: Ceiling access doors.
  - 2. Door: Minimum 22 gage with satin coat.
  - 3. Frame: Minimum 22 gage with satin coat.
  - 4. Hinges: Concealed hinge.
  - 5. Latch: Slotted screwdriver operated cam latch.
  - 6. Lock: Cylinder lock and key.
  - 7. Door Recess: 5/8" to accept 5/8" drywall
  - 8. Basis of Design: Acudor DW-5015 10" x 10" recessed access door.

## 2.03 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view, provide materials with smooth, flat surfaces without blemishes.
- C. 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.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.
  2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.
- F. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

### PART 3 - EXECUTION

#### 3.01 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.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

#### 3.02 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 083113



SECTION 083600 - SECTIONAL OVERHEAD DOORS  
470 SERIES INSULATED STEEL DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Insulated Sectional Overhead Doors.

1.2 RELATED SECTIONS

- A. Section 033000 - Cast-In-Place Concrete: Prepared opening in concrete. Execution requirements for placement of anchors in concrete wall construction.
- B. Section 061000 – Rough Carpentry: Rough wood framing and blocking for door opening.
- C. Section 079200 - Joint Sealants: Perimeter sealant and backup materials.
- D. Section 099123 – Interior Painting: Field painting.
- E. Section 260563 – Equipment Connections and Coordination: Motorized Equipment

1.3 REFERENCES

- A. ANSI/DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

- A. Wiring Connections: Requirements for electrical characteristics.
  - 1. 115 volts, single phase, 60 Hz.
- B. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.5 SUBMITTALS

- A. Submit under provisions of Section 013300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- C. Shop Drawings: Indicate plans and elevations including opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- E. Operation and Maintenance Data.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Installer Qualifications: Authorized representative of the manufacturer with minimum five years documented experience.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened labeled packaging until ready for installation.
- B. Protect materials from exposure to moisture until ready for installation.
- C. Store materials in a dry, ventilated weathertight location.

## 1.8 PROJECT CONDITIONS

- A. Pre-Installation Conference: Convene a pre-installation conference just prior to commencement of field operations, to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

## 1.9 WARRANTY

- A. Warranty: Manufacturer's limited door and operators System warranty for 10 years against delamination of polystyrene foam from steel face and all other components for 1 year and covered under General Conditions of Contract.

# PART 2 PRODUCTS

## 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Overhead Door Corporation, 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499
- B. Substitutions: Or approved equal
- C. Requests for substitutions will be considered in accordance with provisions of Section 012500.

## 2.2 INSULATED SECTIONAL OVERHEAD DOORS

- A. Insulated Steel Sectional Overhead Doors: 470 Series Insulated Steel Doors by Overhead Door Corporation. Units shall have the following characteristics:
  - 1. Door Assembly: Rigid steel construction; fully insulated on the inside face with continuous steel backing on the inside face. Fabricated with steel end stiles and tongue and groove sections.
    - a. Panel Thickness: 2 inches (51 mm).
    - b. Exterior Surface: Ribbed.
    - c. Exterior Steel: 26 gauge, hot-dipped galvanized with an embossed simulated wood grain texture.
    - d. Interior Steel: 29 gauge, hot-dipped galvanized



- e. Springs:
  - 1) 10,000 cycles.
- f. Insulation: Polystyrene.
- g. Thermal Values:
  - 1) Polystyrene - R-value of 9.83; U-value of 0.102.
- h. Partial Glazing of Steel Panels:
  - 1) 42 inch by 13 inch window.
  - (a) DSB
- 2. Finish and Color: Two coat baked-on polyester. Color as follows:
  - a. as selected by owner
- 3. Windload Design: Provide to meet the Design/Performance requirements specified.
- 4. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
- 5. Lock:
  - a. Keyed lock with interlock switch for automatic operator.
  - b. Locking mechanism designed to maintain security for exterior while permitting break out when impacted from the inside.
- 6. Weatherstripping:
  - a. Flexible bulb-type strip at bottom section.
  - b. Flexible Jamb seals.
  - c. Flexible Header seal.
- 7. Track: Provide track as recommended by manufacturer to suit loading required and clearances available.
- 8. Electric Motor Operation: Provide UL listed electric operator, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second. Operator shall meet UL325/2010 requirements for continuous monitoring of safety devices.
  - a. Entrapment Protection: Required for momentary contact, includes radio control operation.
    - 1) Pneumatic sensing edge up to 18 feet (5.5 m) wide. Constant contact only complying with UL 325/2010.
    - 2) Electric sensing edge monitored to meet UL 325/2010.
    - 3) Photoelectric sensors monitored to meet UL 325/2010.
  - b. Operator Controls:
    - 1) Key operated control stations with open, close, and stop buttons.
    - 2) Surface mounting.
    - 3) Both interior and exterior location.
  - c. Special Operation:
    - 1) Pull switch.
    - 2) Vehicle detector operation.
    - 3) Radio control operation.
    - 4) Card reader control.
    - 5) Photocell operation.
    - 6) Commercial light package.
    - 7) Explosion and dust ignition proof control wiring.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation until openings have been properly prepared.
- B. Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

- C. Verify electric power is available and of correct characteristics.
- D. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Clean adjacent surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.3 INSTALLATION

- A. Install overhead doors and track in accordance with approved shop drawings and the manufacturer's printed instructions.
- B. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.
- C. Anchor assembly to wall construction and building framing without distortion or stress.
- D. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- E. Fit and align door assembly including hardware.
- F. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

### 3.4 CLEANING AND ADJUSTING

- A. Adjust door assembly to smooth operation and in full contact with weatherstripping.
- B. Clean doors, frames, glass and polycarbonate according to manufacturer's instructions.
- C. Remove temporary labels and visible markings. Do not remove polycarbonate care and maintenance label required to maintain warranty.

### 3.5 PROTECTION

- A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.
- B. Protect installed products until completion of project.
- C. Touch-up, damaged coatings and finishes and repair minor damage before Substantial Completion.

END OF SECTION 083600

## SECTION 085113 - ALUMINUM WINDOWS

### 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. This Section includes fixed and/or operable aluminum-framed windows and window wall system for exterior locations.
- B. Provide all plant, labor, materials, accessories, equipment, incidentals, scaffolds and supervision necessary to complete window replacement with hardware, exterior trim, components and related work shown and/or specified including but not necessarily limited to the following:
  - 1. Sliding Windows
  - 2. Projected Windows.
  - 3. Fixed /Transom Windows.
  - 4. Removal and reinstallation of window air conditioners exhaust vents, louvers, etc., in insulated aluminum panels.
  - 5. Miscellaneous trim, closures, brake metals, receptors, panning, sills, mullions, mullion covers, and flashing.
- C. Related Sections include the following:
  - 1. Section 079200 "Joint Sealants".
  - 2. Section 088100 "Glazing" for additional glazing requirements for aluminum windows.

#### 1.3 DEFINITIONS

- A. Performance class designations according to AAMA/WDMA/CSA 101/I.S.2/A440-08:
  - 1. AW: Architectural Performance Classification as defined by AAMA/WDMA/CSA 101/I.S.2/A440-08 standards.
- B. Performance grade number according to AAMA/WDMA/CSA 101/I.S.2/A440:
  - 1. Design pressure number in pounds' force per square foot (pascals) used to determine the structural test pressure and water test pressure.
- C. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.
- D. Minimum Test Size: Smallest size permitted for performance class (gateway test size) or as specified elsewhere in this section, whichever is more stringent. Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class. Downsized test reports will not be considered acceptable.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of minimum test size indicated below:
1. Horizontal Sliding Windows: 96" x 78".
  2. Projected Windows: 60" x 144" (Configuration B)
  3. Fixed and Transom Frames: 60" x 99"
- B. AAMA/NWWDA Performance Requirements: Provide aluminum windows of the performance class and grade indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440.
1. Performance Class: AW-PG
  2. Performance Grade: 70 for Sliding Windows; 100 for Projected; 150 for Fixed and Transom Windows
- C. Structural Performance: Provide aluminum windows capable of withstanding the following, including wind loads based on passing, Uniform Load Structural Test, at AAMA/WDMA/CSA 101/I.S.2/A440-8 basic wind speed indicated:
1. Deflection: Based on passing, Uniform Load Deflection Test. AAMA/WDMA/CSA 101/I.S.2/A440
  2. Basic Wind Speed: As indicated in miles per hour at 33 feet above grade. Determine wind loads (30 lbf/sq.ft. minimum) and resulting design pressures applicable to Project according to the following, based on mean roof heights above grade as indicated on Drawings:
    - a. ASCE 7, "Minimum Design Loads for Buildings and Other Structures," Section 6.4.2, "Analytic Procedure."
    - b. Appendix B in AAMA/WDMA/CSA101/I.S.2/A440-08
  3. Design Pressure: 70lbf/sq.ft. for Sliding window; 100lbf/sq.ft. for Projected; 150 lbf/sq.ft. for Fixed
- D. Structural Performance: Provide aluminum windows capable of withstanding the effects of the following loads, based on testing units of the minimum test size specified herein that pass AAMA/WDMA/CSA 101/I.S.2/A440-08
1. Uniform Load Structural Test - ASTM E330:
    - a. 105 psf (positive and negative) for all Horizontal Windows
    - b. 100 psf (positive and negative) for all Projected Windows
    - c. 225 psf (positive and negative) for all Fixed and Transom Windows.
- E. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/WDMA/CSA101/I.S.2/A440-8, Air Infiltration Test.
1. Maximum Rate: 0.06 for Sliding windows, at an inward test pressure of 6.24 lbs./sq. ft. 0.01 cfm/sq.ft. of area for Projected and Fixed windows.
- F. Water Resistance: No water leakage as defined in AAMA/WDMA/CSA 101/I.S.2/A440-8 referenced test methods at a water test pressure equaling that indicated, when tested according to, Water Resistance Test.
1. Test Pressure: 20 percent of positive design pressure, but not less than 15 lbf/sq.ft.

- G. Forced-Entry Resistance: Comply with Performance Level 10 requirements when tested according to ASTM F 588.
- H. Condensation-Resistance Factor: Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a minimum CRF of 52 for all Windows
- I. Thermal Transmittance: Provide aluminum windows with a whole-window U-value maximum indicated at 15-mph exterior wind velocity and winter condition temperatures when tested according to AAMA 1503.
  - 1. U-Value Testing for Hermetically sealed insulated units as specified in section 2.3. as follows:
    - a. Sliding Windows: Maximum U-Value 0.44; Solar Heat Gain Coefficient (SHGC) Maximum of 0.23.
    - b. Projected Windows and Fixed: Maximum U-Value of 0.34; solar Heat Gain Coefficient (SHGC) Maximum 0.31
- J. Thermal Movements: Provide aluminum windows, including anchorage, that accommodate thermal movements of units without buckling, distortion, opening of joints, failure of joint sealants, damaging loads and stresses on glazing and connections.
- K. Projected Windows: Must be flush vent type (overlapping vents will not be acceptable) and must comply with AAMA/WDMA/CSA 101/I.S.2/A440-8 for the following tests, in addition to Gateway Performance Requirements:
  - 1. Hardware Load Test.
  - 2. Sash Torsion Test.
  - 3. Torsion Test.
  - 4. Horizontal Concentrated Load Test on Latch Rail.
  - 5. Vertical Concentrated Load Test on Latch Rail.
  - 6. Torsion Load Test on Intermediate Frame Rails.
  - 7. Vertical Concentrated Load Test on Intermediate Frame Rails.
  - 8. Balance Arm Load Test.
  - 9. Life Cycle Testing: When tested in accordance with AAMA 910.
- L. Fixed Windows: Comply with the Gateway Performance Requirements of AAMA/WDMA/CSA 101/I.S.2/A440-08.
- M. Rescue Windows: Refer to drawing A6.20 for rescue window requirements

#### 1.5 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:
  - 1. Mullion details, including reinforcement and stiffeners.
  - 2. Joinery details.
  - 3. Weather-stripping details.
  - 4. Thermal-break details.
  - 5. Glazing details.

- C. Samples for Initial Selection: For units with factory-applied color finishes.
  - 1. Include similar samples of hardware and accessories involving color selection.
- D. Maintenance Data: For operable window sash, operating hardware and finishes to include in maintenance manuals.
- E. Warranty: Special warranty specified in this Section.

## 1.6 QUALITY ASSURANCE

- A. Product Qualifications: In order to confirm that the proposed product(s) conform to the material and performance requirements contained in these specifications, bidders shall include the following with their bid. Failure to comply with these requirements shall cause the bid to automatically be rejected.
  - 1. Bidder's Acknowledgement: Bidders shall include a letter in their bid stating the manufacturer and series (model) number of the product upon which its bid has been based. Changes in product (manufacturer or series) will not be permitted after the bid.
  - 2. Product Test Reports: Bidders submitting bids based on products other than the Basis of Design product listed in Paragraph 2.1 must also include with their bid comprehensive test reports not more than four years old prepared by a qualified testing agency for each window type being used on the project. Test reports based on the use of downsized test units will not be accepted.
  - 3. Product Details: Bidders submitting bids based on products other than the Basis of Design product listed in Paragraph 2.1 must also include with their bid full size product details showing all frame and sash details, dimensions, thermal break construction, wall thicknesses and joinery. Details must accurately reflect all glazing and hardware options specified herein.
- B. Product Requirements: For maximum performance, windows for this project must meet both the testing requirements as contained herein and the minimum material requirements specified. Windows that carry the applicable AAMA rating but do not meet the material thicknesses, depths, etc. shall not be acceptable for use on this project.
- C. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.
- D. Source Limitations: Obtain All Aluminum Window Types through one source from a single manufacturer.
- E. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum windows and are based on the specific system indicated. Do not modify size and dimensional requirements.
  - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- F. Fenestration Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440-08, "Standard/Specification for Windows, Doors, and Unit Skylights" for definitions and minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

1. Provide AAMA-certified aluminum windows.
- G. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.
- H. Preinstallation Conference: If requested, conduct conference at project site to review methods and procedures related to aluminum windows including, but not limited to, the following:
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  2. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components.
  3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
  4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

## 1.7 PROJECT CONDITIONS

- A. Field Measurements: For retrofit installations, verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Failure to meet performance requirements.
    - b. Structural failures including excessive deflection, water leakage, or air infiltration.
    - c. Faulty operation of movable sash and hardware.
    - d. Deterioration of metals or other materials beyond that which is normal...
  2. Warranty Period:
    - a. Window: Two (2) years from date of Substantial Completion.
    - b. Hermetically Sealed Insulated Glass: Ten years from date of Substantial Completion.
    - c. Painted Metal Finishes:
      - 1) Five (5) years from date of Substantial Completion for AAMA 2603 Baked Enamel Finish.
      - 2) Twenty (20) years from date of Substantial Completion for AAMA 2605 Superior Performance Finishes.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: The basis of design for these specifications is the Series 6500i Horizontal (XX) Sliding Window, 3000i Projected, and 7090i Fixed Window Systems as manufactured by Architectural Window Manufacturing Corporation, Rutherford, New Jersey.
- B. Equivalents: Subject to compliance with all material and performance requirements outlined in these specifications, "or equal" products by other manufacturers will be considered for use subject to review by the Architect. The Architect's decision regarding equivalency is final.

### 2.2 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, and not less than 0.062-inch thickness at any location for the main frame and sash members, except the frame sill which shall be a minimum of 0.094-inch. Double Hung along with Sliding sash and Frame shall have a minimum wall thickness of 0.080 and 0.125 at sill.
- B. Frame/Sash Depth:
  - 1. 4-1/4" minimum frame depth, 1-3/4" minimum sash depth for sliding and fixed/transoms
  - 2. 3-1/2" minimum frame depth, 3-1/2" minimum sash depth for projected/fixed.
- C. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.
  - 1. All fasteners must be concealed except where unavoidable for application of hardware.
  - 2. For application of hardware, where required, use non-magnetic stainless steel phillips machine screws.
- D. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
- E. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.
  - 1. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA/CSA 101/I.S.2/A440-08.
- F. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
  - 1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semi rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.



- G. Replaceable Weather Seals: Comply with AAMA 701/702.
- H. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

## 2.3 INSULATED GLAZING

- A. Construction: All windows (except those receiving insulated panels) shall be factory glazed with hermetically sealed 1" insulating glass units with a dual seal of polyisobutylene and silicone and a desiccant filled aluminum spacer. Insulated glass must be set into a continuous bed of two-part structural silicone sealant and held in place with removable extruded aluminum snap-in beads. Wrap around (marine) glazing which requires the removal and disassembling of the sash for re-glazing will not be acceptable. Units must be IGCC certified for a CBA rating level. Field Glazing will not be acceptable for this project.
  - 1. Exterior Glazing:
    - a. Thickness: 1/4"
    - b. Tint: Clear
    - c. Type: Tempered Glass
    - d. Coating: Solarban 67 Low-E (#2 Surface).
  - 2. Air Space: 90% Argon/ Super Spacer/Tri-seal
  - 3. Interior Glazing:
    - a. Thickness: 1/4"
    - b. Tint: Clear
    - c. Type: Tempered Glass

## 2.4 INSULATED PANELS:

- A. Areas designated to receive insulated panels shall be constructed as follows:
  - 1. Overall Thickness: 1"
  - 2. Exterior Face: Kynar paint on smooth .032" aluminum factory finished in color from manufacturer's full range of colors as selected by Architect.
  - 3. Interior Face: Kynar paint on smooth .032" aluminum in color selected by Architect from manufacturer's full range of available colors.
  - 4. Exterior Substrate: Water-resistant 3/16" Hardboard.
  - 5. Interior Substrate: Water-resistant 3/16" Hardboard.
  - 6. Core: Polyisocyanurate.

## 2.5 LOUVERS:

- A. General: Provide extruded aluminum fixed blade louver complying with AMCA certified rating.
  - 1. Frame: 2" Deep 0.061" 6063 T5/T6 Extruded aluminum alloy.
  - 2. Blades: 0.050" 6063 T5/T6 Extruded aluminum alloy.
  - 3. Sill Pan: 0.050 Thick formed aluminum.
  - 4. Screen: 1/2" Removal Aluminum Bird Screen, located on interior
  - 5. Finish: Match exterior window finish.

## 2.6 HARDWARE

- A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals.
- B. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
- C. Horizontal Sliding Windows: Provide the following operating hardware:
  - 1. Sash Rollers: Two stainless steel, lubricated roller assemblies with stainless steel ball-bearing rollers.
  - 2. Removable Lift-Out Sash: Design windows whereby both sash operate for ventilation and are removable from inside for cleaning and maintenance, and provide with hardware to permit removal of sash from inside for cleaning. (Products of "XO" design with only one operable/removable sash will not be acceptable).
  - 3. Sill Cap/Track: Removable sill insert with an extruded-aluminum raised track of thickness dimensions, and profile indicated; designed to comply with performance requirements indicated and allow for drainage into the main tank and to the exterior through concealed weeps with hinged covers. Raised track must be covered with a stainless-steel cap.
  - 4. Roller Assemblies: Low-friction design.
  - 5. Sash Lock: Spring-loaded black zinc die cast plunger lock with black anodized aluminum keeper on meeting rails.
  - 6. Sash Lock: Spring-loaded, aluminum snap-type lock at end jamb of exterior ("0") sash.
  - 7. Limit Device: Continuous extruded aluminum sash stop limit device with rubber bumper; for each operable sash; mounted at window sill to limit operation to 8".
- E. Projected Windows: Provide the following operating hardware:
  - 1. Hinge: Concealed four-bar friction hinge complying with AAMA 904 with adjustable-slide friction shoe; two per ventilator. Provide limiters to prevent windows from opening into public traffic areas.
  - 2. Lock: Cam-action, white bronze locking handle and keeper (two per ventilator over 42" wide).
  - 3. Lock: Provide pole-operated automatic white bronze locks on inward acting ventilators, where the distance to the operating hardware exceeds six feet above the floor.

## 2.6 INSECT SCREENS

- A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Locate screens on outside of window. Provide insect screens on all operable sashes.
- B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
  - 1. Extruded-Aluminum Tubular Framing Sections and Cross Braces: Not less than 0.050-inch (1.3-mm) wall thickness.
  - 2. Finish: Match aluminum window members.

- C. Glass-Fiber Mesh Fabric: 18-by-16 (1.0-by-1.1-mm) mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration; in the following color. Comply with ASTM D 3656.

- 1. Mesh Color: Charcoal gray.

## 2.7 ACCESSORIES

- A. Rescue Labels: Windows designated on drawings as "Rescue" or "Egress" windows shall meet all applicable codes and shall include a conforming label.

## 2.8 FABRICATION:

- A. General: Fabricate aluminum windows, in sizes indicated, that comply with requirements and that meet or exceed AAMA/WDMA/CSA 101/I.S.2/A440-08 performance requirements for the following window type and performance class. Include a complete system for assembling components and anchoring windows.
  - 1. Sliding Windows: AW
  - 2. Projected Windows: AW
  - 3. Fixed/Transom Windows: AW
- B. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.
- C. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed (products with exposed thermal barriers will not be acceptable), low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
  - 1. All exterior aluminum shall be separated from interior aluminum by a rigid, structural thermal barrier. For purposes of this specification, a structural thermal barrier is defined as a system that shall transfer shear during bending and, therefore, promote composite action between the exterior and interior extrusions.
  - 2. No thermal short circuits shall occur between the exterior and interior.
  - 3. The thermal barrier shall consist of a thermal strut design and consist of two glass reinforced polyamide nylon 6/6 struts mechanically crimped in raceways extruded in the exterior and interior extrusions.
  - 4. Poured and debridged urethane thermal barriers shall not be permitted.
- D. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.
- E. Weep Holes: Provide weep holes with hinged covers and internal passages to conduct infiltrating water to exterior.
- F. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.
- G. Subframes: Provide drainable subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.093-inch thick extruded aluminum. Finish shall match window units. Provide subframes capable of withstanding design loads of window units.

- H. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 8 Section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440-08.
- I. Glazing Stops: Provide Snap-on glazing stops coordinated with Division 8 Section "Glazing" and glazing system as indicated. Provide glazing stops to match sash and ventilator frames.
- J. Insulated Panels: Panels must be factory glazed, set into a continuous bed of two-part Structural silicone sealant and held in place with removable extruded aluminum snap-in beads.

## 2.8 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. Exterior of Window:

- 1. Superior-Performance Organic Finish: AA-C12C40R1x (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 AAMA 2605 and with coating and resin manufacturer's written instructions.
  - a. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605
  - b. Color: Full Range of Custom Blues. (Note: Exterior color may be different from interior color.)

### D. Interior of Window:

- 1. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
  - a. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603.
  - b. Color: As selected by Architect from manufacturer's standard Non-Metallic colors.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions

affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
- D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

### 3.3 FACTORY TESTING

- A. One window for each seventy-five manufactured shall be randomly selected by the Owner and Architect to be tested at the manufacturer's facility for air and water infiltration to confirm compliance of the project's windows with the performance requirements contained in these specifications. Bidders are to include the cost of transportation, food, and lodging for four representatives of the Owner and/or Architect to witness these tests.

### 3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
- B. Manufacturer shall clean all glass and aluminum prior to shipment.
- C. Protection of newly installed windows and/or final cleaning of glass and aluminum to remove any accumulations that may have occurred during the construction period are to be the responsibility of the General Contractor or Owner.
- D. Comply with manufacturer's written recommendations for final cleaning and maintenance.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain window operating system.

END OF SECTION 085113

## SECTION 087100 – DOOR 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 commercial door hardware for the following:
  - 1. Swinging doors.
  - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
  - 1. Mechanical door hardware.
  - 2. Cylinders specified for doors in other sections.
- C. Related Sections:
  - 1. Division 08 Section “Hollow Metal Doors and Frames”.
  - 2. Division 08 Section “Flush Wood Doors”.
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 2. ICC/IBC - International Building Code.
  - 3. NFPA 70 - National Electrical Code.
  - 4. NFPA 80 - Fire Doors and Windows.
  - 5. NFPA 101 - Life Safety Code.
  - 6. NFPA 105 - Installation of Smoke Door Assemblies.
  - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
  - 1. ANSI/BHMA Certified Product Standards - A156 Series.
  - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies.
  - 3. CAN/ULC-S104 – Standard Method for Fire Tests of Door Assemblies.
  - 4. ANSI/UL 294 – Access Control System Units.
  - 5. ULC-S319 - Electronic Access Control Systems.

6. ULC-60839-11-1, Alarm and Electronic Security Systems - Part 11-1: Electronic Access Control Systems - System and Components Requirements.
7. CAN-ULC-S132 -- Standard Method of Tests for Emergency Exit and Emergency Fire Exit Hardware.
8. CAN-ULC-S533 - Egress Door Securing and Releasing Devices.
9. UL 305 – Panic Hardware.
10. ULC-S132, Emergency Exit and Emergency Fire Exit Hardware.
11. ULC-S533 – Egress Door Securing and Releasing Devices.
12. ANSI/UL 437- Key Locks.
13. ULC-S328, - Burglary Resistant Key Locks.

### 1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
    - h. Warranty information for each product.
  4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the 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 Schedule.



- C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- D. Informational Submittals:
  - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware 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.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
  - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
1. Function of building, purpose of each area and degree of security required.
  2. Plans for existing and future key system expansion.
  3. Requirements for key control storage and software.
  4. Installation of permanent keys, cylinder cores and software.
  5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
  2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
  3. Review sequence of operation narratives for each unique access controlled opening.
  4. Review and finalize construction schedule and verify availability of materials.
  5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

#### 1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

## 1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
  - 1. Structural failures including excessive deflection, cracking, or breakage.
  - 2. Faulty operation of the hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
  - 1. Seven years for heavy duty cylindrical (bored) locks and latches.
  - 2. Five years for exit hardware.
  - 3. Twenty five years for manual overhead door closer bodies.

## 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 Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

## 2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
  1. Quantity: Provide the following hinge quantity:
    - a. Two Hinges: For doors with heights up to 60 inches.
    - b. Three Hinges: For doors with heights 61 to 90 inches.
    - c. Four Hinges: For doors with heights 91 to 120 inches.
    - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
  2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
    - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
    - b. Sizes from 3'1" to 4'0": 5" heavy weight.
  3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
    - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
    - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
  4. Hinge Options: Comply with the following:
    - a. Non-removable 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 the all out-swinging lockable doors.
  5. Manufacturers:
    - a. Bommer Industries (BO).
    - b. Hager Companies (HA).
    - c. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a

minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

- a. Bommer Industries (BO).
- b. Hager Companies (HA).
- c. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

## 2.3 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:

- a. Door Controls International (DC).
- b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
- c. Trimco (TC).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:

- a. Hiawatha, Inc. (HI).
- b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
- c. Trimco (TC).

## 2.4 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders: Original manufacturer cylinders complying with the following:
  - 1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
  - 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  - 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
  - 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
  - 5. Keyway: Match Facility Standard.
- D. Keying System: Each type of lock and cylinders to be factory keyed.
  - 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
  - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
  - 3. Existing System: Field verify and key cylinders to match Owner's existing system.
- E. Key Quantity: Provide the following minimum number of keys:
  - 1. Change Keys per Cylinder: Two (2)
  - 2. Master Keys (per Master Key Level/Group): Five (5).
  - 3. Construction Keys (where required): Ten (10).
- F. Construction Keying: Provide construction master keyed cylinders.
- G. Key Registration List (Bitting List):
  - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
  - 2. Provide transcript list in writing or electronic file as directed by the Owner.

## 2.5 KEY CONTROL

- A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
  - 1. Manufacturers:
    - a. Lund Equipment (LU).
    - b. MMF Industries (MM).

- c. Telkee (TK).

## 2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed.
  - 1. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at paired openings) throw brass or stainless steel latchbolt.
  - 2. Locks are to be non-handed and fully field reversible.
  - 3. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.2 requirements to 2 million cycles.
  - 4. Manufacturers:
    - a. Corbin Russwin Hardware (RU) – CL3300 Series.
    - b. Sargent Manufacturing (SA) – 10 Line.
    - c. Schlage (SC) – ND Series.

## 2.7 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
  - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
  - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
  - 3. Short-Lip: For use with astragal.
  - 4. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
  - 5. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
  - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
  - 2. Strikes for Bored Locks and Latches: BHMA A156.2.
  - 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
  - 4. Dustproof Strikes: BHMA A156.16.

## 2.8 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
  2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
  3. Except on fire rated doors, provide exit devices with key cylinder dogging device to hold the pushbar and latch in a retracted position.
  4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
  5. Flush End Caps: Provide flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
  6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
    - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
  7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
  8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
  9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
  10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
  11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:
    - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
    - b. Sargent Manufacturing (SA) - 80 Series.
    - c. Von Duprin (VD) - 35A/98 XP Series.



## 2.9 DOOR CLOSERS

### A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

### B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

#### 1. Manufacturers:

- a. Corbin Russwin Hardware (RU) – DC6000 Series.
- b. Norton Door Controls (NO) – 7500 Series.
- c. Sargent Manufacturing (SA) – 351 Series.

### C. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted closers with door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.

#### 1. Manufacturers:

- a. Corbin Russwin Hardware (RU) – Unitrol Series.
- b. Norton Door Controls (NO) – Unitrol Series.

## 2.10 ARCHITECTURAL TRIM

### A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
  - a. Stainless Steel: 300 grade, .050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
  - a. Hiawatha, Inc. (HI).
  - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
  - c. Trimco (TC).

## 2.11 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
  1. Manufacturers:
    - a. Hiawatha, Inc. (HI).
    - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    - c. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and

shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

- a. Rixson Door Controls (RF).
- b. Sargent Manufacturing (SA).
- c. Glynn Johnson.

## 2.12 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. National Guard Products (NG).
2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
3. Reese Enterprises, Inc. (RE).

## 2.13 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## 2.14 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine scheduled openings, 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. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

### 3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

### 3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically 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."

3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and 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.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### 3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Section "Closeout Procedures" for project punch and reporting requirements including compliance with approved submittals and verification door hardware is properly installed, operating and adjusted.

### 3.5 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.

### 3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### 3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

### 3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RO - Rockwood
4. RU - Corbin Russwin
5. RF - Rixson
6. NO - Norton

#### **Hardware Sets**

##### **Set: 1.0**

Description: Exterior

1 Continuous Hinge	CFM-HD1 Series		PE
1 Rim Exit Device, Classroom	ED5200 N955ET M52	630	RU
1 Surface Closer	UNI7500	689	NO
1 Kick Plate	K1050 10" 4BE CSK	US32D	RO
1 Threshold (coord w/ details)	273x292AKFGPK		PE
1 Head & Jamb Gasketing	2891APK		PE
1 Rain Guard (head mount)	346C DOW + 4"		PE
1 Sweep	315CN		PE

##### **Set: 2.0**

Description: Vestibule

1 Continuous Hinge	CFM-HD1 Series		PE
1 Rim Exit Device, Classroom	ED5200 N955ET M52	630	RU
1 Surface Closer	UNI7500	689	NO
1 Kick Plate	K1050 10" 4BE CSK	US32D	RO
1 Threshold (coord w/ details)	271A FHSL14SS		PE
3 Silencer	608		RO

**Set: 3.0**

Description: Break Room

3 Hinge (heavy weight)	T4A3786 (qty, size, nrp per spec)	US26D	MK
1 Entrance Lock	CL3351 NZD	626	RU
1 Surface Closer	R/PR 7500	689	NO
1 Kick Plate	K1050 10" 4BE CSK	US32D	RO
1 Door Stop	401; 404; 441CU (or per spec)	US26D	RO
1 Head & Jamb Seal (adhesive)	S442BL		PE

**Set: 4.0**

Description: Toilet / Changing

1 Continuous Hinge	CFM-HD1 Series		PE
1 Privacy Lock	CL3320 NZD	626	RU
1 Surface Closer	UNI7500	689	NO
1 Kick Plate	K1050 10" 4BE CSK	US32D	RO
3 Silencer	608		RO
1 Coat Hook	806	US26D	RO

**Set: 5.0**

Description: Closet

3 Hinge, Full Mortise	TA2314 (qty, size, nrp per spec)	US32D	MK
1 Storeroom Lock	CL3357 NZD	626	RU
1 Surface Overhead Stop	10-X36	630	RF
3 Silencer	608		RO

**Set: 6.0**

Description: Closet Pair

6 Hinge, Full Mortise	TA2714 (qty, size, nrp per spec)	US26D	MK
1 Dust Proof Strike	570	US26D	RO
2 Flush Bolt (manual)	555	US26D	RO
1 Classroom Lock	CL3355 NZD	626	RU
2 Surface Overhead Stop	10-X36	630	RF
2 Silencer	608		RO

**Set: 7.0**

Description: Paper Storage Pair

6 Hinge (heavy weight)	T4A3386 (qty, size, nrp per spec)	US32D	MK
1 Dust Proof Strike	570	US26D	RO
2 Flush Bolt Set (self-latching)	2845; 2945	US26D	RO
1 Storeroom Lock	CL3357 NZD	626	RU
2 Surface Closer	R/PR 7500	689	NO
2 Kick Plate	K1050 10" 4BE CSK	US32D	RO
2 Door Stop	401; 404; 441CU (or per spec)	US26D	RO
1 Head & Jamb Seal (adhesive)	S442BL		PE
1 Astragal Seal (adhesive)	S442BL		PE
1 Astragal (flat bar)	357SP		PE

**Set: 8.0**

Description: Overhead Door

1 Hardware

Supplied with door assembly

00

END OF SECTION 087100



## SECTION 088100 – GLASS AND GLAZING

### PART 1 - GENERAL

#### 1.1 GENERAL PROVISIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

#### 1.2 SUMMARY

- A. This Section includes glass and glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
  - 1. Interior and exterior hollow metal doors and fixed frames.
  - 2. Interior and exterior Aluminum doors and frames.
  - 3. Interior and exterior Aluminum store front windows and curtain wall.
  - 4. Interior wood doors.

#### 1.3 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
  - 1. Division 8 Section "Hollow Metal Doors and Frames": for steel doors and fixed hollow metal framed openings receiving glass and glazing.
  - 2. Division 8 Section "Flush Wood Doors": for wood doors vision lites receiving glass and glazing.

#### 1.4 REFERENCES

- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ASTM C 1036 - Flat Glass.
  - 2. ASTM C 1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
  - 3. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
  - 4. Federal Safety Standards for Architectural Glazing Materials 16CFR1201-I.II.
- B. The following reference materials are hereby made a part of this Section by reference thereto:
  - 1. FGMA - Glazing Manual, and Sealant Manual.
  - 2. Consumer Product Safety Commission-Safety Standard for Architectural Glazing Materials.

## 1.5 SUBMITTALS

- C. Submit the following under provisions of Division 01 Section "Submittal Procedures".
  - 1. Product data sheets on glazing products: Provide chemical, functional, and environmental characteristics, size limitations, special application requirements. Identify available colors.
  - 2. Warranty: Provide copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof
  - 3. Samples:
    - a. 12 by 12 inch pieces of each specified type and thickness of glass, bearing labels indicating locations where each type of glass will be used.
    - b. Glazing tape: 12 inch length of specified type and size.
  - 4. All interior glass and glazing must comply with NFPA 80 and/or ASTM E119 (as applicable).

## 1.6 QUALITY ASSURANCE:

- A. Source: For each glass and glazing type required for work of this Section, provide primary materials which are products of one manufacturer. Provide secondary or accessory materials which are acceptable to manufacturers of primary materials.
- B. Installer: A firm with a minimum of three years experience in type of work required by this Section and which is acceptable to manufacturers of primary materials.
- C. Glass Thickness: Determine and provide size and thickness of glass products that are certified to meet or exceed performance requirements specified in this Section. Provide units with proper thickness, edge clearance and tolerance to comply with recommendations of glass manufacturer.
- D. Perform work in accordance with FGMA Glazing Manual Sealant Manual.

## 1.7 EXAMINATION OF SITE AND DOCUMENTS

- A. The bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Subcontractor's failure to familiarize themselves with the contractor documents or site conditions. By submitting a bid, the bidder agrees and warrants that he has had the opportunity to examine the site and the contract documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the contract documents are adequate and that he will produce the required results.
- B. Pre-Bid Conference: Pre-Bid conference will be held on site; refer to Advertisement for Bids for time and date.

## 1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers

and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 50°F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

#### 1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations and FGMA Manual.
1. Protect materials from moisture, sunlight, excess heat, sparks and flame.
  2. Sequence deliveries to avoid delays, but minimize on-site storage.

#### 1.10 WARRANTIES

- A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.
- B. Manufacturer's Special Project Warranty on Laminated Glass:
1. Warranty Period: Manufacturer's standard but not less than 5 years after date of substantial completion.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

#### 2.2 GLASS - GENERAL

- A. General requirements for glass: Of domestic manufacture, conforming to the referenced standards and with the additional requirements specified herein; factory labeled on each pane stating the strength, type, thickness and quality; with all labels remaining on glass until final cleaning.
- B. Fabricate glass as required to openings with edge clearances and bite on glass as recommended by the manufacturer with clean-cut edges where concealed, and smooth ground, polished and seamed edges where exposed to view. Do not cut, seam, nip or abrade glass after tempering.
1. For non-tempered to be cut at site, provide glass larger than required so as to obtain clean cut edges without seaming or nipping. Laminated glass products should not be cut on site.
- C. Glass thickness shown and heat treatment specified are minimum requirements. Provide glass thickness and heat treatment as required to meet specified performance criteria, State and local codes and ordinances.

## 2.3 NON-SECURITY GLASS TYPES

- A. Tempered Float Glass; ASTM C 1048, Kind FT, Condition A, Type I, Class 1, tempered by the manufacturer's standard process (after cutting to final size).
  - 1. Thickness: 1/4 inch.
  - 2. Manufacturers:
    - a. Pilkington North America
    - b. PPG Industries, Inc, Glass Group, Pittsburgh, PA.
    - c. NSG Group, Toledo, OH.
    - d. or equal
- B. Laminated Safety Glass; two sheets of double-strength clear sheet glass; ASTM C 1036, Type I, Class 1, quality q3; permanently laminated together with a minimum 0.030 inch thick sheet of clear plasticized polyvinyl butyl, which has been produced specifically for laminating glass.
  - 1. Thickness: 1/4 inch.
  - 2. Manufacturers:
    - a. Pilkington North America
    - b. PPG Industries, Inc., Glass Group, Pittsburgh, PA.
    - c. LTI Group, Pittsfield MA
    - d. or equal
- C. Laminated Noise-Reducing Glass; ASTM C 1036, Type I, applicable Class for glass indicated below, quality q3; provide the following components to produce units of the thickness and light transmittance indicated, tested and certified to provide the indicated STC rating for the sizes required in accordance with ASTM E 90.
  - 1. Exterior Glass: Tempered glass.
  - 2. Laminating Sheet: Acoustic PVB sheet, minimum 0.045 inch thick.
  - 3. Interior Glass: Laminated glass.
  - 4. Manufacturers:
    - a. Pilkington North America
    - b. PPG Industries, Inc., Glass Group, Pittsburgh, PA.
    - c. LTI Group, Pittsfield MA
    - d. or equal
- D. Organically Sealed Insulating Glass Units; ASTM C 1036, applicable Type and Class for glass indicated below, quality q3 for Type I glass; manufacturer's standard edge construction of spacers and sealants permanently bonded to glass surfaces and hermetically sealed to provide a dehydrated air space 1/2 inch thick with -60 degrees F. dew point; fabricated of the following glass.
  - 1. Exterior Glass: Tempered float glass.
  - 2. Interior Glass: Laminated glass.
  - 3. Glass Thickness(es): As indicated on the Drawings.
  - 4. Manufacturers:
    - a. Pilkington North America
    - b. PPG Industries, Inc., Glass Group, Pittsburgh, PA.
    - c. NSG Group, Toledo, OH.
    - d. LTI Group, Pittsfield, MA
    - e. or equal

## 2.4 SINGLE PANE SECURITY GLASS TYPES

- A. Product established as performance standard. Substitution must provide certified independent testing of performance data equal to specified product (see 2.6 for further details).
- B. Security Glazing.
  - 1. Basis-of-Design Product: SG4 by School Guard Glass as manufactured by Laminated Technologies Inc. (844) 744-5277 or equal.
    - a. Security glazing shall have the following characteristics
      - i. No more than 4.1 lbs. per square foot
      - ii. 5-aa1 rated for a minimum of 6 minutes
      - iii. Glass clad on interior and exterior surfaces
      - iv. Optical Haze of no more than 1.8%

## 2.6 SECURITY GLASS TESTING METHODOLOGY FOR "OR EQUAL SUBSTITUTION"

- A. Security Glazing: Security glass and surrounding frames shall demonstrate the ability, through independent third party testing, to provide the following attributes:
  - 1. Products will be tested as a whole system, including glass and doors or frames.
  - 2. Products tested shall be tested in full size, actual doors and framing members usable in a commercial setting, as applicable to project requirements, with security glazing installed as prescribed by the security glazing manufacturer. Testing shall not be done in framing other than what is specified in regards to quality or manufacturer as stated in the Contract Documents.
  - 3. Glass bite during testing shall be no more than the allowable glass bite in the specified door or framing system for this project.
  - 4. The security glass shall resist attack for a minimum of 6 minutes or greater to meet the desired level of protection required by the owner.
  - 5. Attack duration shall be continuous. Breaks between testing phases shall not be counted or timed for total duration.
  - 6. Security glass will be integrated into a framing system in such a way that the frame and glass are able to withstand a constant attack for 6 minutes.
  - 7. Attack resistance shall mean the security glazing is subjected to the following without failure:
    - a. Withstand a minimum of 5 shots from a military style assault rifle with a minimum caliber of 7.62mm.
    - b. Withstand a minimum of abuse as applied by a single assailant at full force and including strikes with feet, bricks, hammers, baseball bats, and sledgehammers without stoppage for 6 or 12 minutes.
  - 8. Failure is defined as a tear in the security glass large enough to allow an object 4-inches in diameter or more to pass through or separation made between the glass and surrounding door frame, storefront or curtain wall framing materials.
  - 9. Product shall not be damaged or scratched by scissors, writing implements, razor blades or the use of any similar sharp object.
  - 10. Glass shall not have an optical haze of more than 1.8% so glass is indistinguishable from standard tempered glass.
- B. Test reports from a recognized independent testing company shall show testing means and methodology consistent or similar to the 5-aa1 assault test.

## 2.7 GLAZING MATERIALS

- A. Glazing Material: Silicone Rubber Glazing Sealant; silicone rubber one-part elastomeric sealant; FS TT-S-001543, Class A; acid-type for non-porous channel surfaces, and nonacid type where any of the channel surfaces are porous.
  - 1. Manufacturers and Products:
    - a. "995" by Dow Corning.
    - b. or equal.
- B. Preformed Butyl Rubber Glazing Sealant; tape or ribbon (coiled on release paper) of polymerized butyl, or mixture of butyl and polyisobutylene, compounded with inert fillers and pigments, solvent-based with minimum 95 percent solids, thread or fabric reinforcement, tack-free within 24 hours, paintable, non-staining.
- C. Molded Neoprene Glazing Gaskets; molded or extruded neoprene gaskets of the profile and hardness required for watertight construction; ASTM D 2000 designation 2BC 415 to 3BC 620.
- D. Pure silicone caulk, closed cell PVC tape, or DAP 33 putty as recommended by Technical Glass Products to comply with U.L. Listing. Must be used for fire-rated glass to meet fire rated labeling requirements.
- E. Colors: For exposed materials provide color as indicated or, if not indicated, as selected by the Director from the manufacturer's standard colors. For concealed materials, provide any of the manufacturer's standard colors.
- F. Setting Blocks: Neoprene, 70-90 durometer hardness, with proven compatibility with sealants used.
- G. Spacers: Neoprene, 40-50 durometer hardness, with proven compatibility with glazing materials used.
- H. Compressible Filler Rod: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, proven to be compatible with glazing materials used, flexible and resilient, with 5-10 psi compression strength for 25 percent deflection.
- I. Cleaners, Primers and Sealers: Type recommended by glazing material manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION AND PREPARATION

- A. Inspect receiving surfaces and ensure that are dry and free from dust, or other foreign materials before glazing. Clean all surfaces with cloth saturated with mineral spirits of high-flash naphtha as recommended by glazing tape manufacturer, before glazing.
- B. Check all openings, prior to glazing, to make certain that the opening is square, plumb and secure in order that uniform face and edge clearances are maintained.
- C. Determine the actual sizes required by measuring the receiving openings. Size glass and

mirrors to permit required clearance and bite around full perimeter of glass, as set forth in the referenced FGMA standards, or as recommended by the glass manufacturer. Do not nip edges, to remove flares or to reduce oversize dimensions, under any circumstance.

- D. Perform glazing work in accordance with FGMA Glazing Manual SIGMA and LSGA standards for glazing and installations methods.

### 3.2 INSTALLATION

- A. Each installation shall withstand normal temperature changes, applicable wind loading, and impact loading (for operating sash and doors) without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the Work.
- B. Install glass in accordance with the standards detailed in the "Glazing Manual" of the Glass Association of North America and the "Sealant Manual" of the Flat Glass Marketing Association except as shown and specified otherwise, and except as specifically recommended otherwise by the manufacturers of the glass and glazing materials.
- C. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, draw and bow oriented in the same direction as other pieces.
- D. Install glazing materials in accordance with the manufacturer's printed instructions.

### 3.3 GLAZING

- A. Install setting blocks of proper size at quarter points of sill rabbet. If required to keep in place set blocks in thin course of the heel-bead compound.
- B. Provide spacers inside and out, and of proper size and spacing, for all glass sizes larger than 50 united inches, except where gaskets are used for glazing. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.
- C. Voids and Filler Rods: Prevent exudation of sealant or compound by forming voids or installing filler rods in the channel at the heel of jambs and head (do not leave voids in the sill channels) except as otherwise indicated, depending on light sizes, thickness and type of glass, and complying with manufacturer's recommendations.
- D. Do not cut, seam, nip, or abrade glass which is tempered, heat strengthened, or coated.
- E. Force glazing materials into channel to eliminate voids and to ensure complete "wetting" or bond of glazing material to glass and channel surfaces.
- F. Tool exposed surfaces of glazing sealants and compounds to provide a substantial "wash" away from the glass. Install pressurized tapes and gaskets to protrude slightly out of the channel, so as to eliminate dirt and moisture pockets.
- G. Where wedge-shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when subjected to dynamic movement. Anchor gasket to stop

with matching ribs, or by proven adhesives, including embedment of gasket tail in cured heel bead.

- H. Gasket Glazing: Miter cut and bond ends together at corners where gaskets are used for channel glazing, so that gaskets will not pull away from corners and result in voids or leaks in the glazing system.

#### 3.4 CURE, PROTECTION AND CLEANING

- A. Cure glazing materials in accordance with manufacturer's printed instructions and recommendations, to obtain high early bond strength, internal cohesive strength, and surface durability.
- B. Mark glazed openings immediately upon installation of glass by attaching crossed streamers to framing. Do not apply markers of any type to surfaces of glass.
- C. Replace glass included in the work which is broken, or otherwise damaged, from the time Work is started at the site until the date of physical completion.
- D. Maintain glass in a reasonably clean condition during construction to protect from buildup of harmful construction contaminants.
  - 1. Clean and trim excess glazing material from the glass and stops or frames promptly after installation.
- E. When directed, just before Substantial Completion, remove dirt and other foreign material and wash and polish glass included in the work on both sides.

END OF SECTION 088100



## SECTION 089000 – LOUVERS AND VENTS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. Section Includes:
  - 1. Fixed, extruded-aluminum louvers.

#### 1.03 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.
- C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

#### 1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
  - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
  - 2. Show mullion profiles and locations.
  - 3. Wiring Diagrams: For power, signal, and control wiring for motorized adjustable louvers.

#### 1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
  - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

- 3. AWS D1.6, "Structural Welding Code - Stainless Steel."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.
- D. UL and NEMA Compliance: Provide motors and related components for motor-operated louvers that are listed and labeled by UL and comply with applicable NEMA standards.

#### 1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
- B. Fasteners: Use types and sizes to suit unit installation conditions.
  - 1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
  - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
- C. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

#### 2.02 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide extended sills for recessed louvers.

#### 2.03 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Drainable-Blade Louver:
  - 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. Arrow United Industries; a division of Mestek, Inc.
  - b. Carnes Company, Inc.
  - c. Greenheck Fan Corporation.
  - d. Louvers & Dampers, Inc.; a division of Mestek, Inc.
  - e. Ruskin Company; Tomkins PLC.
  - f. United Enertech Corp.
- 2. Louver Depth: 4 inches.
- 3. Frame and Blade Nominal Thickness: Not less than 0.081 inch for blades and 0.081 inch for frames.
- 4. Mullion Type: Exposed.
- 5. Louver Performance Ratings:
  - a. Free Area: Not less than 54% for 48-inch- wide by 48-inch- high louver.
  - b. Point of Beginning Water Penetration: Not less than 870 fpm.
- 6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

#### 2.04 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
  - 1. Screen Location for Fixed Louvers: Interior face.
- B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
  - 1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.
  - 2. Finish: Same finish as louver frames to which louver screens are attached.
- D. Louver Screening for Aluminum Louvers:
  - 1. Bird Screening: Flattened, expanded aluminum, 5/8 by 0.040 inch thick.

#### 2.05 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

### 3.03 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required.

### 3.04 ADJUSTING AND CLEANING

- A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
  - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089000

## SECTION 090561 - WATER VAPOR EMISSION CONTROL SYSTEM FOR CONCRETE SLABS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Testing and application of systems for the reduction of moisture vapor transmission and alkalinity control for interior concrete slabs scheduled for floor finish of epoxy flooring systems.

#### 1.2 RELATED SECTIONS

- A. Section 033000 - Cast-In Place Concrete: Installation and curing requirements according to ACI 302.
- B. Section 096723 – Resinous Flooring.

#### 1.3 REFERENCES

- A. American Society of Testing and Materials (ASTM):
  - 1. C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
  - 2. C 348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
  - 3. D 1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
  - 4. E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
  - 5. F 1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Floor Using Anhydrous Calcium Chloride.
  - 6. F 2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- B. International Concrete Repair Institute (ICRI) Guideline No. 03732 - Selecting and Specifying Concrete; Surface Preparation for Sealers, Coatings and Polymer Overlays.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Section 013300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Manufacturer's specification.
  - 2. Installation instructions.
  - 3. Independent test data.
  - 4. Certification requirements.
  - 5. Warranty information.
- C. Pre-Construction Testing: Submit anhydrous calcium chloride test results. Test shall be performed according to ASTM F 1869. Test shall be performed by the General Contractor and submitted to the Architect, and manufacture's site representative.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
  - 1. Manufacturer shall have no less than five years experience in manufacturing water vapor reduction systems. The water vapor reduction system shall be specifically formulated and marketed for water vapor reduction and alkalinity control. System design shall provide protection from vapor emission rates less than or equal to 20 pounds per 1000 square feet per 24 hours and/or 98% relative humidity.
- B. Installer Qualifications:
  - 1. Applicator shall be approved by the manufacturer, experienced in surface preparation and application of the material and shall be subject to inspection and control by the manufacturer.
  - 2. Installer shall have no less than five years experience installing the specified fluid based coating systems.
- C. Product Performance History:
  - 1. Manufacturer shall provide independent lab test reports documenting performance per the following:
    - a. ASTM E 96, Water Vapor Transmission (wet methods) Performance shall be documented by an independent testing laboratory indicating a minimum of 90 percent water vapor transmission reduction compared to untreated concrete.
    - b. ASTM D 1308; Insensitivity to alkaline environment up to pH 14.
    - c. Certify acceptance and exposure to continuous topical water contact after final cure.
  - 2. Submit list of product use and performance history, for the same formulation and system design, listing reference sources. Similar projects shall have documented minimum initial water vapor transmission rates of 20 lb per 1000 sf per 24 hours to 3 lb per 1000 sf per 24 hours, and have resulted in maintained water vapor reduction rate of less than 3 lb per 1000 sf per 24 hours when tested according to ASTM F1869.
- D. Mock-up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  - 1. Finish areas designated by Architect.
  - 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
  - 3. Refinish mock-up area as required to produce acceptable work.

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to the job site in their original unopened containers, clearly labeled with the manufacturer's name and brand designation.
- B. Store products in an approved ventilated dry area; protect from dampness, freezing, and direct sun light. Product should not be stored in areas with temperatures in excess of 90 degrees F (32 degrees C) or below 50 degrees F (10 degrees C).
- C. Handle product in a manner that will prevent breakage of containers and damage products.

## 1.7 PROJECT CONDITIONS

- A. Select a floor covering system scheduled for the treated concrete substrate having the ability to withstand water vapor transmission levels up to 3 lb per 1000 sf (1.5 kg/100 sq. m) /24 hours.
- B. Maintain environmental conditions (temperature, humidity and ventilation) within limits

recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1. Do not apply moisture vapor reduction system to unprotected surfaces or when water is accumulated on the surface of the concrete.
2. Do not apply water vapor reduction system when temperature is lower than 50 degrees F (10 degrees C) or expected to fall below this temperature within 24 hours from time of application.
3. Allow continuous ventilation and indirect air movement at all times during application and curing process of the water vapor reduction system.
4. Protection: Protect water vapor reduction system to prevent damage from active rain or surface water for a minimum of 24 hours from time of application.

## 1.8 SCHEDULING

- A. Before installation of VCT, sheet vinyl, rubber flooring, wood, carpet and/or epoxy flooring systems over the interior concrete slabs, anhydrous calcium chloride testing shall be performed per ASTM F 1869 or ASTM F 2170 by the General Contractor to determine the level of water vapor transmission or relative humidity in the slab and the application rate of the moisture vapor reduction system required.
- B. The General Contractor will coordinate the scheduling of the water vapor reduction system testing, allowing adequate time to test, review results and determine the water vapor reduction system application rate before installation of floor finish is required.
- C. The General Contractor will allow a reasonable period of time (Minimum of 3 days) for the concrete slab to cure and dry before performing anhydrous calcium chloride tests. All mastics, glues, curing compounds and contaminants shall be removed to provide a clean, sound, concrete substrate prior to performing anhydrous calcium chloride tests.

## 1.9 WARRANTY

- A. Manufacturer shall provide the Owner with a system warranty including adhesives and surface preparation products for a period of no less than ten years at no additional cost.
- B. Installer of water vapor reduction system shall provide standard installation warranty for workmanship.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design Manufacturer: CHAPCO / H.B. Fuller Construction Products Inc.: 1105 S. Frontenac Street, Aurora, IL 60504, email: [charlie.renner@hbfuller.com](mailto:charlie.renner@hbfuller.com), web: [www.chapco-adhesive.com](http://www.chapco-adhesive.com).
- B. Substitutions: As approved by Architect.

### 2.2 SYSTEM

- A. Single Coat System: 2-component, VOC Compliant, Low viscosity, 100 percent solid epoxy formulated as a vapor barrier against high moisture and alkalinity in concrete substrates. The water vapor reduction system shall, after final cure, reduce vapor emissions from a maximum of 98 percent relative humidity and alkalinity reduction to acceptable pH levels.
  1. Product: CHAPCO'S DEFENDER as manufactured by CHAPCO / H.B. Fuller Construction Products, Aurora, IL.
  2. A Single Coat System consists of one coat of CHAPCO'S DEFENDER coating to be applied to a properly prepared concrete surface at an application rate determined by an anhydrous calcium chloride tests or RH in situ probes.

3. Mix Component A and B at a ratio per manufacturers strict instructions.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Inspect surfaces with manufacturer's representative to determine its suitability to receive the moisture vapor reduction system. Provide an uncontaminated, sound surface.
- B. Clean surfaces to receive moisture vapor reduction system. Shot blast floors and clean surfaces to remove residue from the substrate. Remove defective materials, and foreign matter such as dust, adhesives, leveling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, shot blast abrasive residue, etc.
- C. Repair cracks, expansion joint, control Joints, and open surface honeycombs.
  1. Use CHAPCO'S DEFENDER mixed 1:1 by volume with clean, white fine silica sand. Force mixture into cracks and joints with a trowel or putty knife. Comply with requirements listed in manufacturer's technical data information. No exceptions. Consult with vapor reduction manufacturer.
- D. Verify that surfaces to be treated with moisture vapor reduction system have not previously been treated with materials such as underlayments, screeds, penetrating sealants, etc.
  1. Consult with vapor reduction system manufacturer prior to application.
- E. Verify if concrete additives such as chlorides or other soluble compounds that may contaminate surfaces have been used in the concrete mix.
  1. Consult with vapor reduction system manufacturer prior to application.
- F. Do not acid etch surface.
- G. Verify that the substrate surface does not deteriorate due to the presence of sulphurous compounds or alkaline aggregate/silica reaction encountered in certain areas.
  1. Consult with vapor reduction system manufacturer prior to application.
  2. Testing for concrete deficiencies / contamination such as alkaline silica reaction, untreated silicates, organic residue, etc. is the responsibility of the General Contractor.
- H. The surface substrate shall remain uncontaminated, absorptive, and sound prior to receiving a water vapor reduction system. Comply with all requirements as listed in manufacturer's technical data information. No exceptions.

### 3.3 APPLICATION

- A. Single Coat System Application:
  1. The coverage rates for the Single Coat System are dependant on the surface texture and porosity of the substrate.
  2. Required Application Rate Relative to Existing Levels of Moisture Vapor to Achieve 3 lb/1000 sf / 24 hours Moisture Levels:
    - a. Up to 20 lb/1000 sf / 24 hr: 130-180 s / gallon.
  3. Apply one coat of CHAPCO'S DEFENDER™ Moisture Vapor Barrier using a



squeegee. Allow 5 minutes for surface to "off gas". Back roll CHAPCO'S DEFENDER with a 3/8 inch (9.5 mm) nap roller to achieve uniform, continuous application of membrane. Allow the minimum cure time before installing the finish flooring.

### 3.4 TESTING

#### A. Initial Tests:

1. Anhydrous calcium chloride testing shall be performed by the installer.
2. Provide initial anhydrous calcium chloride tests according ASTM F 1869 to the prepared concrete surfaces. Tests shall be performed on properly prepared concrete. No exceptions!
3. Conduct calcium chloride tests at the same temperature and humidity as designed normal occupancy. If this is not possible, test conditions shall be 75 degrees F +/-10 degrees (24 degree C +/- 5 degrees) and 50 percent +/-10 percent relative humidity. Maintain these conditions 48 hours prior to and during tests. Water vapor transmission levels are directly affected by ambient room temperature and readings conducted without a sustained ambient temperature are not acceptable.
4. Installer shall provide test results with a marked up floor finish plan showing test results. General Contractor shall provide a written clarification on status of the ambient air temperature and humidity before and during the testing procedures.
5. Installer shall provide a marked up floor plan showing areas with vapor reduction system recommendations.

#### B. Post-Treatment / Pre-Flooring Tests:

1. Before installation of VCT, sheet vinyl, rubber flooring, wood, carpet, and / or epoxy flooring systems and after proper cure of the final coat of the water vapor reduction system provide anhydrous calcium chloride tests according ASTM F 1869. Allow the vapor mitigation system to cure 72 hours before performing test. Water vapor transmission and alkalinity tests shall be performed on properly treated concrete. No exceptions!
2. The installer shall provide test results of the level of water vapor transmission and alkalinity of the concrete slab to all parties involved. The flooring manufacturer and installer shall accept the floor condition and certify that the flooring application materials and methods are compatible with the test results and floor condition.

#### C. Adhesion

1. The flooring installer shall verify the usage of CHAPCO Multipurpose Primer prior to the installation of any patches or floor prep materials. Non permeable flooring systems require the application of a cementitious skim coat, such as CHAPCO SmoothFinish™, entirely covering CHAPCO'S DEFENDER and Multipurpose Primer prior to the installation of Floor Covering.

### 3.5 CLEANING

- #### A.
- Remove all debris resulting from water vapor reduction system installation from project site.

### 3.6 PROTECTION

- #### A.
- Protect each coat during specified cure period from any kind of traffic, topical water and contaminants.

END OF SECTION 090561



## SECTION 092900 - GYPSUM BOARD

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. Section Includes:
  - 1. Interior gypsum board.
  - 2. Exterior gypsum board for ceilings and soffits.
- B. Related Requirements:
  - 1. Section 061000 "Rough Carpentry"

#### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
  - 1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
  - 2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

#### 1.04 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

#### 1.05 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Moisture- and Mold-Resistant Assemblies: Provide and install moisture- and mold-resistant glass-mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C 1658 and ASTM C 1177 where indicated on Drawings and in all locations which might be subject to moisture exposure during construction. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- D. Low-Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

### 2.02 GYPSUM BOARD, GENERAL

- A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

### 2.03 INTERIOR GYPSUM BOARD

- A. Basis-of-Design Product: The design for each type of gypsum board and related products is based on Georgia-Pacific Gypsum products named. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
  1. American Gypsum.
  2. CertainTeed Corp.
  3. Lafarge North America Inc.
  4. National Gypsum Company.
  5. PABCO Gypsum.
  6. Temple-Inland.
  7. USG Corporation.
- B. Gypsum Wallboard: ASTM C 1396/C 1396M.

1. Basis-of-Design Product: Georgia-Pacific Gypsum; DensArmor Plus High-Performance Interior Panel.
2. Thickness: 1/2 inch.
3. Long Edges: Tapered.

C. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Basis-of-Design Product: Georgia-Pacific Gypsum; DensArmor Plus Fireguard High-Performance Interior Panel.
2. Thickness: 5/8 inch.
3. Long Edges: Tapered.

D. Abuse-Resistant Gypsum Board: ASTM C 1629/C 1629M, [Level 1] [Level 2] [Level 3].

1. Basis-of-Design Product: Georgia-Pacific Gypsum; "[DensArmor Plus Abuse-Resistant Panel]".
2. Thickness: 5/8 inch.
3. Long Edges: Tapered.

E. Impact-Resistant Gypsum Board: ASTM C 1629/C 1629M.

1. Basis-of-Design Product: Georgia-Pacific Gypsum; "DensArmor Plus Impact-Resistant Panel".
2. Thickness: 5/8 inch.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.04 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:
  - a. Cornerbead.
  - b. Bullnose bead.
  - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
  - d. L-Bead: L-shaped; exposed long flange receives joint compound.
  - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
  - f. Expansion (control) joint.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

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. Fry Reglet Corp.
  - b. Gordon, Inc.
  - c. Pittcon Industries.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

## 2.05 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  1. Interior Gypsum Board: Paper.
  2. Exterior Gypsum Soffit Board: Paper.
  3. Exterior Glass Mat Gypsum Soffit: Fiberglass mesh.
  4. Glass-Mat Gypsum Wallboard: 10-by-10 fiberglass mesh.
  5. Glass-Mat Gypsum Sheathing Board: 10-by-10 fiberglass mesh.
  6. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  1. Prefilling: At open joints rounded or beveled panel edges and damaged surface areas, use setting-type taping compound.
    - a. Basis-of-Design Product: Georgia-Pacific Gypsum; ToughRock Setting Compound or ToughRock Sandable Setting Compound.
  2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.
    - a. Basis-of-Design Product: Georgia-Pacific Gypsum; ToughRock Setting Compound, ToughRock Sandable Setting Compound, ToughRock Ready Mix All-Purpose Joint Compound.
    - b. Use setting-type compound for installing paper-faced metal trim accessories.
  3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
    - a. Basis-of-Design Product: Georgia-Pacific Gypsum; ToughRock Setting Compound, ToughRock Sandable Setting Compound, ToughRock Ready Mix All-Purpose Joint Compound, ToughRock Ready Mix Topping Joint Compound.
  4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.
    - a. Basis-of-Design Product: Georgia-Pacific Gypsum; ToughRock Setting Compound, ToughRock Sandable Setting Compound, ToughRock Ready Mix All-Purpose Joint Compound, ToughRock Ready Mix Topping Joint Compound.
  5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound, drying-type, all-purpose compound, high-build interior coating product designed for

application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

- a. Basis-of-Design Product: Georgia-Pacific Gypsum; ToughRock Setting Compound, ToughRock Sandable Setting Compound, ToughRock Ready Mix All-Purpose Joint Compound, ToughRock Ready Mix Topping Joint Compound.

## 2.06 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. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Laminating adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
  - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. 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.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
    - b. Grabber Construction Products; Acoustical Sealant GSC.
    - c. Pecora Corporation; [AC-20 FTR] [AIS-919].
    - d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
    - e. USG Corporation; SHEETROCK Acoustical Sealant.
  - 2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Acoustical joint sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch 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. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with



manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### 3.03 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:

- 1. Wallboard Type: As indicated on Drawings.
- 2. Type X: As indicated on Drawings.
- 3. Abuse-Resistant Type: As indicated on Drawings.
- 4. Impact-Resistant Type As indicated on Drawings.

- B. Single-Layer Application:

- 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
- 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
  - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
  - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
- 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

- C. Multilayer Application:

- 1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
- 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
- 3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
- 4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

### 3.04 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.
- C. Interior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners unless otherwise indicated.
  - 2. Bullnose Bead: Use at outside corners.
  - 3. LC-Bead: Use at exposed panel edges.
  - 4. L-Bead: Use where indicated.
  - 5. U-Bead: Use at exposed panel edges.

### 3.05 FINISHING GYPSUM BOARD

- 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 rounded or beveled edges and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 2: Panels that are substrate for tile.
  - 3. Level 3: Where indicated on Drawings.
  - 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
  - 5. Level 5: Where indicated on Drawings.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

### 3.06 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900



## SECTION 095113 - ACOUSTICAL TILE CEILINGS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This Section includes acoustical tiles for ceilings and the following:
  - 1. Concealed suspension systems.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

#### 1.03 DEFINITIONS

- A. CAC: Ceiling Attenuation Class.
- B. LR: Light Reflectance coefficient.
- C. NRC: Noise Reduction Coefficient.

#### 1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
  - 1. Ceiling suspension assembly members.
  - 2. Method of attaching hangers to building structure.
    - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  - 5. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).
- C. Samples for Initial Selection: For components with factory-applied color finishes.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
  - 1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.
  - 2. Concealed Suspension System Members: 12-inch- (300-mm-) long Sample of each type.

- 3. Exposed Moldings and Trim: Set of 12-inch- (300-mm-) long Samples of each type and color.
- E. Qualification Data: For testing agency.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical tile ceiling.
- G. Research/Evaluation Reports: For acoustical tile ceiling and components and anchor type.
- H. Maintenance Data: For finishes to include in maintenance manuals.

#### 1.05 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
- B. Source Limitations:
  - 1. Acoustical Ceiling Tile: Obtain each type through one source from a single manufacturer.
  - 2. Suspension System: Obtain each type through one source from a single manufacturer.
- C. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide acoustical tile ceilings that comply with the following requirements:
  - 1. Fire-Resistance Characteristics: Where indicated, provide acoustical tile ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
    - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
    - b. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 2. Surface-Burning Characteristics: Provide acoustical tiles with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
    - a. Smoke-Developed Index: 450 or less.
- E. Seismic Standard: Provide acoustical tile ceilings designed and installed to withstand the effects of earthquake motions according to the following:
  - 1. 2000 International Building Code New Jersey Edition.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they

will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

- B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

#### 1.07 COORDINATION

- A. Coordinate layout and installation of acoustical tiles and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

#### 1.08 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. Acoustical Ceiling Units: Full-size units equal to 5.0 percent of quantity installed.
  - 2. Suspension System Components: Quantity of each concealed grid and exposed component equal to 2.0 percent of quantity installed.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

#### 2.02 ACOUSTICAL TILES, GENERAL

- A. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
  - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
- B. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
  - 1. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

- C. Tile-Based Antimicrobial Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial solution that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria.
- D. All finishes as scheduled on Drawing A5.01 for ceiling types.

## 2.03 ACOUSTICAL TILES TYPES

- A. Refer to Drawing A5.01 for Ceiling Types

## 2.04 METAL SUSPENSION SYSTEMS

- A. Components: Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A 653. Main beams and cross tees are double-web steel construction with exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.
  - 1. Structural Classification: ASTM C 635 Intermediate Duty
  - 2. Color: White and match the actual color of the selected ceiling tile, unless noted otherwise.
- B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
- C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft annealed, with a yield stress load of at least three times design load, but not less than 12 gauge.
- D. Basis of Design Product: Prelude XL 15/16" Exposed Tee as manufactured by Armstrong World Industries
- E. Or Equal Products by the following:
  - 1. Chicago Metallic Corporation.
  - 2. Fry Reglet Corporation.
  - 3. Gordon, Inc.
  - 4. MM Systems, Inc.
  - 5. USG Interiors, Inc.
- F. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical tile edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
  - 1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- G. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with the following requirements:



1. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
  - a. Organic Coating: Thermosetting, enamel primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils (0.02 to 0.03 mm).

## 2.05 ACOUSTICAL SEALANT

### A. Products:

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.
2. Acoustical Sealant for Concealed Joints:
  - a. OSI Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
  - b. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
  - c. Pecora Corp.; BA-98.
  - d. Tremco, Inc.; Tremco Acoustical Sealant.

- B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

## 2.06 MISCELLANEOUS MATERIALS

- A. Tile Adhesive: Type recommended by tile manufacturer, bearing UL label for Class 0-25 flame spread.
  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).
- B. Staples: 5/16-inch- (8-mm-) long, divergent-point staples.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical tile ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.
- B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

### 3.03 INSTALLATION, SUSPENDED ACOUSTICAL TILE CEILINGS

- A. General: Install acoustical tile ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
  - 5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  - 6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
  - 7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  - 8. Do not attach hangers to steel deck tabs.
  - 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  - 10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.66 m). Miter corners accurately and connect securely.
  3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Arrange directionally patterned acoustical tiles as follows:
1. As indicated on reflected ceiling plans.
  2. Install tiles with pattern running in one direction parallel to long axis of space.
  3. Install tiles with pattern running in one direction parallel to short axis of space.
  4. Install tiles in a basket-weave pattern.
- G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
  2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches (305 mm) o.c.
  3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.
- 3.04 CLEANING
- A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113



## SECTION 096513 - RESILIENT BASE AND ACCESSORIES

### 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. Resilient base.
  - 2. Resilient molding accessories.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than **12 inches** long.
- C. Samples for Initial Selection: For each type of product indicated.
- D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than **12 inches** long.
- E. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Furnish not less than 20 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

#### 1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Coordinate mockups in this Section with mockups specified in other Sections.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

## 1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 VINYL BASE

- A. Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).
  - 1. Group: I (solid, homogeneous) or II (layered).
  - 2. Style and Location:
    - a. Style A, Straight: Provide in areas with carpet.
    - b. Style B, Cove: Provide in areas with resilient flooring.
  - 1) Profile: As indicated
- B. Thickness: **0.125 inch**
- C. Height: As indicated on Drawings.
- D. Lengths: Coils in manufacturer's standard length..
- E. Outside Corners: Job formed or preformed.
- F. Inside Corners: Job formed or preformed.
- G. Colors: As selected by Architect from full range of industry colors.

## 2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
  - 1. Adhesives shall have a VOC content of 50 g/L or less.
  - 2. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.
- D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.
- E. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:
  - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
  - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum **75** percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are the same temperature as the space where they are to be installed.
  1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
  1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 6 inches in length.
    - a. Form without producing discoloration (whitening) at bends.
  2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 6" in length.



- a. Miter or cope corners to minimize open joints.

### 3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
  - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
  - 2. Tightly adhere to substrates throughout length of each piece.
  - 3. For treads installed as separate, equal-length units, install to produce a flush joint between units.
- C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

### 3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum horizontal surfaces thoroughly.
  - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.
  - 1. Apply one coat.
- E. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513



## SECTION 096723 - RESINOUS FLOORING

### PART 1 – GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This section includes the following:
  - 1. Resinous flooring system as shown on the drawings and in schedules.
- B. Related sections include the following:
  - 1. Cast-in-Place Concrete, section 033000
  - 2. Water Vapor Emission Control System for Concrete Slabs, section 090561

#### 1.03 SYSTEM DESCRIPTION

- A. The work shall consist of preparation of the substrate, the furnishing and application of a cementitious urethane based self-leveling seamless flooring system with decorative chip broadcast and Epoxy broadcast and topcoats.
- B. The system shall have the color and texture as specified by the Owner with a nominal thickness of 3/16 inch. It shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.
- C. Cove base (if required) to be applied where noted on plans and per manufacturers standard details unless otherwise noted

#### 1.04 SUBMITTALS

- A. Product Data: Latest edition of Manufacturer's literature including performance data and installation procedures.
- B. Manufacturer's Material Safety Data Sheet (MSDS) for each product being used.
- C. Samples: A 3 x 3 inch square sample of the proposed system. Color, texture, and thickness shall be representative of overall appearance of finished system subject to normal tolerances.

#### 1.05 QUALITY ASSURANCE

- A. The Manufacturer shall have a minimum of 10 years experience in the production, sales, and technical support of epoxy and urethane industrial flooring and related materials.
- B. The Applicator shall have experience in installation of the flooring system as confirmed by the manufacturer in all phases of surface preparation and application of the product specified.
- C. No requests for substitutions shall be considered that would change the generic type of the specified System.

- D. System shall be in compliance with requirements of United States Department of Agriculture (USDA), Food, Drug Administration (FDA), and local Health Department.
- E. System shall be in compliance with the Indoor Air Quality requirements of California section 01350 as verified by a qualified independent testing laboratory.
- F. A pre-installation conference shall be held between Applicator, General Contractor and the Owner to review and clarification of this specification, application procedure, quality control, inspection and acceptance criteria and production schedule.

#### 1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

##### A. Packing and Shipping

- 1. All components of the system shall be delivered to the site in the Manufacturer's packaging, clearly identified with the product type and batch number.

##### B. Storage and Protection

- 1. The Applicator shall be provided with a dry storage area for all components. The area shall be between 60 F and 85 F, dry, out of direct sunlight and in accordance with the Manufacturer's recommendations and relevant health and safety regulations.
- 2. Copies of Material Safety Data Sheets (MSDS) for all components shall be kept on site for review by the Engineer or other personnel.

##### C. Waste Disposal

- 1. The Applicator shall be provided with adequate disposal facilities for non-hazardous waste generated during installation of the system.

#### 1.07 PROJECT CONDITIONS

##### A. Site Requirements

- 1. Application may proceed while air, material and substrate temperatures are between 60 F and 85 F providing the substrate temperature is above the dew point. Outside of this range, the Manufacturer shall be consulted.
- 2. The relative humidity in the specific location of the application shall be less than 85 % and the surface temperature shall be at least 5 F above the dew point.
- 3. The Applicator shall ensure that adequate ventilation is available for the work area. This shall include the use of manufacturer's approved fans, smooth bore tubing and closure of the work area.
- 4. The Applicator shall be supplied with adequate lighting equal to the final lighting level during the preparation and installation of the system.

##### B. Conditions of new concrete to be coated with cementitious urethane material.

- 1. Concrete shall be moisture cured for a minimum of 3 days and have fully cured a minimum of 5 days in accordance with ACI-308 prior to the application of the coating system pending moisture tests.
- 2. Concrete shall have a flat rubbed finish, float or light steel trowel finish (a hard steel trowel finish is neither necessary nor desirable).
- 3. Sealers and curing agents should not be used.
- 4. Concrete shall have minimum design strength of 3,500 psi. and a maximum water/cement ratio of 0.45.

5. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.

C. Safety Requirements

1. All open flames and spark-producing equipment shall be removed from the work area prior to commencement of application.
2. "No Smoking" signs shall be posted at the entrances to the work area.
3. The Owner shall be responsible for the removal of foodstuffs from the work area.
4. Non-related personnel in the work area shall be kept to a minimum.

1.08 WARRANTY

- A. Manufacturer shall warrant that material shipped to buyers at the time of shipment substantially free from material defects and will perform substantially to Manufacturer published literature if used in accordance with the latest prescribed procedures and prior to the expiration date.
- B. Manufacturer liability with respect to this warranty is strictly limited to the value of the material purchase.

PART 2 – PRODUCTS

2.01 FLOORING

- A. Basis of Design: Dur-A-Flex, Inc, Hybri-Flex EC (self-leveling chip broadcast), epoxy/aliphatic urethane topcoat seamless flooring system.
  1. System Materials:
    - a. Topping: Dur-A-Flex, Inc, Poly-Crete MD resin, hardener and SL aggregate.
    - b. The broadcast aggregate shall be Dur-A-Flex, Inc. Macro, Microchip or Earthstone Chip Blend.
    - c. Broadcast: Dur-A-Flex, Inc. Dur-A-Glaze #4, epoxy based two-component resin.
    - d. Seal coats: Dur-A-Flex, Inc Dur-A-Glaze #4, epoxy-based, two-component resin.
    - e. Top coat: Dur-A-Flex, Inc. Armor Top aliphatic urethane 2 component resin with grit.
  2. Finish - Orange Peel Finish
  3. Patch Materials
    - a. Shallow Fill and Patching: Use Dur-A-Flex, Inc. Poly-Crete MD (up to ¼ inch).
    - b. Deep Fill and Sloping Material (over ¼ inch): Use Dur-A-Flex, Inc. Poly-Crete WR.

2.02 MANUFACTURER

- A. Basis of Design: Dur-A-Flex, Inc., 95 Goodwin Street, East Hartford, CT 06108, Phone: (860) 528-9838, Fax: (860) 528-2802
- B. Architect Approved Equal.

2.03 PRODUCT REQUIREMENTS

- |  |                           |
|--|---------------------------|
| A. Topping                               | Poly-Crete SL             |
| 1. Percent Reactive                      | 100 %                     |
| 2. VOC                                   | 0 g/L                     |
| 3. Bond Strength to Concrete ASTM D 4541 | 400 psi, substrates fails |
| 4. Compressive Strength, ASTM C 579      | 9,000 psi                 |

5.	Tensile Strength, ASTM D 638	2,175 psi
6.	Flexural Strength, ASTM D 790	5,076 psi
7.	Impact Resistance @ 125 mils, MIL D-3134, No visible damage or deterioration	160 inch lbs
B.	Broadcast Coat	Dur-A-Glaze #4 Resin
1.	Percent Reactive,	100 %
2.	VOC	<4 g/L
3.	Water Absorption, ASTM D 570	0.04%
4.	Tensile Strength, ASTM D 638	4000psi
5.	Coefficient of thermal expansion ASTM D 696,	2 x 10 <sup>-5</sup> in/in/F
6.	Flammability ASTM D-635	Self-Extinguishing
7.	Flame Spread/ NFPA 101 ASTM E-84	Class A
C.	Topcoat	Armor Top
1.	VOC	0 g/L
2.	60 Degree Gloss ASTM D523	75+/-5
3.	Mixed Viscosity, (Brookfield 25°C)	500 cps
4.	Tensile strength, ASTM D 638	7,000 psi
5.	Abrasion Resistance, ASTM D4060 CS 17 wheel (1,000 g load) 1,000 cycles	Gloss    Satin 4        8 mg loss with grit 10      12 mg loss without grit
6.	Pot life @ 70° F 50% RH	2 hours
7.	Dry properties, 70°F, 50% R.H. 60°F, 30% RH 80°F, 70%RH	8 hours tack free, 12 hours Dry 12 hours tack free, 18 hours Dry 4 hours tack free, 6 hours Dry
8.	Flash Point PMCC	186°F
9.	Full Chemical resistance	7 days

## PART 3 – EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance.
  1. Verify that substrates and conditions are satisfactory for flooring installation and comply with requirements specified.

### 3.02 PREPARATION

#### A. General

1. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.
2. Moisture Testing: Perform tests recommended by manufacturer and as follows.
  - a. Perform anhydrous calcium chloride test ASTM F 1869-98. Application will proceed only when the vapor/moisture emission rates from the slab is less than and not higher than 20 lbs/1,000 sf/24 hrs.
  - b. Perform relative humidity test using is situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 99% relative humidity level measurement.
  - c. If the vapor drive exceeds 99% relative humidity or 20 lbs/1,000 sf/24 hrs then the Owner and/or Engineer shall be notified and advised of additional cost for the possible

installation of a vapor mitigation system that has been approved by the manufacturer or other means to lower the value to the acceptable limit.

3. Mechanical surface preparation
  - a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 4-5 as described by the International Concrete Repair Institute.
  - b. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
  - c. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch key cut shall be made to properly seat the system, providing a smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.
  - d. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired per manufacturer's recommendations.
4. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufactures recommendations.

### 3.03 APPLICATION

#### A. General

1. The system shall be applied in five distinct steps as listed below:
  - a. Substrate preparation
  - b. Topping/overlay application with chip broadcast.
  - c. Resin application with chip broadcast.
  - d. Topcoat application
  - e. Second topcoat application.
2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.
3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
5. A neat finish with well-defined boundaries and straight edges shall be provided by the applicator.

#### B. Topping

1. The topping shall be applied as a self-leveling system as specified by the Architect. The topping shall be applied in one lift with a nominal thickness of 1/8 inch.
2. The topping shall be comprised of three components, a resin, hardener and filler as supplied by the Manufacturer.
3. The hardener shall be added to the resin and thoroughly dispersed by suitably approved mechanical means. SL Aggregate shall then be added to the catalyzed mixture and mixed in a manner to achieve a homogenous blend.
4. The topping shall be applied over horizontal surfaces using 1/2 inch "v" notched squeegee, trowels or other systems approved by the Manufacturer.
5. Immediately upon placing, the topping shall be degassed with a loop roller.
6. Chip aggregate shall be broadcast to excess into the wet resin, Macro chip at the rate of 0.1 lbs/sf and Micro chip at the rate of 0.15 lbs/sf.
7. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose chips.

C. Broadcast

1. The broadcast coat resin shall be applied at the rate of 100 sf/gal.
2. The broadcast coat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high speed paddle mixer.
3. Chip aggregate shall be broadcast into the wet resin, Macro chips at the rate of 0.1 lbs/sf, Micro chips at the rate of 0.15 lbs/sf.
4. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose chips.

D. Topcoat

1. The first topcoat shall be squeegee applied with a coverage rate of 100 sf/gal.
2. The topcoat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high speed paddle mixer.
3. The first topcoat will be back rolled and cross rolled to provide a uniform texture and finish
4. The second topcoat with grit shall be roller applied with a coverage rate of 500 sf/gal.
5. The finish floor will have a nominal thickness of 3/16 inch.

3.04 FIELD QUALITY CONTROL

A. Tests, Inspection

1. The following tests shall be conducted by the Applicator:
  - a. Temperature
    1. Air, substrate temperatures and, if applicable, dew point.
  - b. Coverage Rates
    1. Rates for all layers shall be monitored by checking quantity of material used against the area covered.

3.05 CLEANING AND PROTECTION

- A. Cure flooring material in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.
- B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

END OF SECTION 096723



## SECTION 099123 – INTERIOR PAINTING

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES: (See Paint Schedule and finish designations)

- A. Interior painting where required at disturbed finishes, to match existing.

#### 1.02 DEFINITIONS

- A. "Paint or Painting" as used in this specification, are in a general sense and include: Sealers, primers, stains; oil, alkyd, latex, epoxy, and enamel type paints; lacquers; fillers; and the application of these materials.

#### 1.03 PRODUCT SUBMITTALS

- A. Product Data: Listing of proposed products matched to specified products. Cut sheet for each product indicating generic formulation, sheen, ingredients, percentage by volume, and breakdown of pigment versus vehicle.
- B. Samples: Full range of custom mixed color chips for selection.

#### 1.04 CONTRACT CLOSEOUT SUBMITTALS

- A. Maintenance Materials: Turn over to Owner upon completion; one gallon of each type and color of finish. Include color pigmentation formulation.

#### 1.05 PACKING AND DELIVERY

- A. Delivery: Unopened containers with manufacturer's labels indicating type of paint, stock number, color number and instructions.

#### 1.06 STORAGE AND PROTECTION

- A. Storage: Do not store volatiles, thinners, and solvents (including rags and tool cleaning pails) within the building.

#### 1.07 ENVIRONMENTAL REQUIREMENTS

- A. Temperature:
  - 1. Interior: Constant 65 degrees F. or above. Prevent wide variations in temperature which might result in condensation.
- B. Avoid painting any surfaces while they are exposed to hot sun.
- C. Provide proper conditions of ventilation and light; use artificial light in quantity equivalent to normal occupancy lighting.

### PART 2 - PRODUCTS

#### 2.01 PAINT AND FINISHES

- A. Manufacturer:  
Benjamin Moore Paint Co. (Product #s specified on Drawings)

Sherwin Williams (Product #s specified in Specification)  
Pratt & Lambert, Inc.  
ICI Glidden  
M.A. Bruder & Sons, Inc.  
Duron Paints & Wallcoverings  
PPG Industries

- B. Specific products are indicated in painting schedule included at the end of this Section. These products establish a standard of quality. Others may be required to substantiate properties and qualities.
- C. Ready-mixed; well ground, not settle badly, cake or thicken in the container, readily broken up with a paddle to a smooth consistency; and having easy brushing properties; Lead free.
- D. Colors: Standard colors.
  - 1. Color shall be from manufacturer's line of standard colors.

### PART 3 - EXECUTION

#### 3.01 PREPARATION

- A. Inspection and Surfaces:
  - 1. Carefully examine executed work of other trades which might affect this work.
- B. Protect materials and equipment from damage by painting and finishing.
  - 1. Tape, mask, cover and/or coat adjacent materials, areas, surfaces, and equipment not to receive finishes noted in this Section. Specifically protect wood floors and natural unfinished wood.
  - 2. Before painting, remove hardware, accessories, plates and similar items or provide ample protection of such items.
  - 3. Remove doors, if necessary, to paint bottom edge.
  - 4. Use only skilled mechanics for removing and replacing such items. Upon completion of each space, replace above items.
- C. General Preparation of Surfaces:
  - 1. Prepare all surfaces in accordance with manufacturer's recommendations for product being used.
  - 2. Surfaces: Clean; dry; free of moisture and dampness; smooth, even, true to plane; and free of material which will adversely affect adhesion or appearance of applied coating.

#### 3.02 PREPARATION- METAL SURFACES TO BE PAINTED

- A. Thoroughly clean metal surfaces where rust or scale is present, by the use of wire brushing and/or abrasive paper.
- B. Wash surfaces with mineral spirits to remove any grease, oil or dirt.

- C. Touch-up all shop primed or coated surfaces chipped or abraded, using shop coat material specified. Feather edges of damaged shop coat to achieve smooth finish. Comply with metal preparation as indicated by the manufacturer of the coating.

### 3.03 PREPARATION- GYPSUM BOARD SURFACES

- A. Fill all minor irregularities with spackling compound and sand to smooth, level surfaces. Exercise care to avoid raising nap of paper.
- B. Allow to cure at least 15 days before painting.
- C. Do not use sandpaper on paper surfaces to be painted.
- D. Do not apply paint or sealer when moisture content exceeds that required by paint manufacturer.

### 3.04 APPLICATION OF PAINTS

- A. General Requirements: Comply with manufacturer's instructions including environmental conditions, temperatures, pot life, drying and recoating times. Utilize tools and equipment recommended for products.
  - 1. Do not apply coating until moisture content of surface is within limitations recommended by the paint manufacturer. Test with moisture meter.
  - 2. Apply paint, enamel, stains and varnishes with suitable brushes, rollers or spray equipment which have been kept clean, free from contamination and suitable for finish required.
  - 3. Rate of application of coating shall not exceed that as recommended by the paint manufacturer for the purpose of surface involved.
  - 4. Sand and dust between each coat to remove visible defects and blemishes.
- B. Coverage:
  - 1. Apply not less than 2 separate and distinct coats of finish on all exposed Work throughout.
  - 2. Apply to shop or factory primed surfaces not less than 1 finish coat; in addition to the prime coat.
  - 3. Apply additional coats should there be a deficiency in coverage.
  - 4. Apply additional coats over entire surface until paint film is of uniform finish, color appearance and coverage, specifically when previous color, stain, dirt, spackle, patching or undercoats show through final coats.
  - 5. If problems arise in connection with application of paint, stop painting area immediately and contact paint manufacturer for recommendation.
- C. Methods of Application:
  - 1. Brush Application: Brush each coat out uniformly to eliminate laps, skips and excess brush marks. Brush apply field coats on metals, and trim.

2. Roller Application: Use proper skill to avoid signs of lapping and excess paint lines from edge of roller. When cutting in with a brush is required, these areas must be of same texture, color and hiding as adjacent areas, to ensure good appearance.
3. Spray Application: Absolute masking and protective measures shall be taken to avoid damage to other finish materials. Manufacturer's recommendations for dry mil thickness are minimums and square feet per gallon shall not be exceeded. Paints shall not be diluted for purpose of spraying.

D. Drying:

1. Do not apply any type finish until the preceding coats are thoroughly dry and hard.
2. Interior Paint: Allow to dry at least 24 hours between coats.
3. Exterior Paint: Allow to dry at least 48 hours between coats.

E. Appearance: (As visible from 3 feet)

1. Smooth and even; free from runs, sags, skips, streaks and holidays.
2. No variation in sheen or color within continuous surfaces.
3. No clogging of lines and angles of shapes and details.
4. Edges (adjoining other materials or other colors): Paint sharp and clean without overlapping.
5. Coats: Proper consistency and well spread so as to show no laps and brush marks.

3.05 REPAIR AND CORRECTION

- A. Repair damage (resulting from painting) done to the Work of others and existing Work.
- B. Correct Work damage caused by drafty, dusty conditions or cold, to complete satisfaction, without additional cost.
- C. Refinish entire surface where portion of finish has been damaged or is not acceptable.
- D. No claims will be allowed for correction of defective Work caused by failure to adequately prepare substrates and abide by manufacturers recommendations.

3.06 CLEANING

- A. Touch-up and restore where finish is damaged.
- B. Remove spilled, splashed or splattered paint from all surfaces.
- C. Do not mar surface finish of item being cleaned.
- D. Leave storage spaces clean and in condition required for equivalent spaces in project. Leave premises clean and free from all rubbish and accumulated material left from this Work.

PART 4 - SCHEDULE - INTERIOR SURFACES (NORMAL EXPOSURE)

4.01 SCHEDULE

A. METAL - (Aluminum)

1. Latex Systems:

a. Semi-Gloss Finish:

1st Coat: S-W Pro Industrial Pro Cryl Universal Primer B66-1310 (5.0 wet, 2.0 dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss B31W02651 Series  
3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss B31W02651 Series  
(4 mils wet, 1.5 mils dry per coat)

B. METAL - (Galvanized)

1. Latex Systems:

a. Semi-Gloss Finish:

1st Coat: S-W Pro Industrial Pro Cryl Universal Primer B66-1310 (5.0 wet, 2.0 dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss B31W02651 Series  
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss B31W02651 Series  
(4 mils wet, 1.3 mils dry per coat)

b. Flat Finish:

1st Coat: S-W ProMar 200 Zero VOC Latex Flat Wall Paint, B3OW12650  
2nd Coat: S-W ProMar 200 Zero VOC Latex Flat Wall Paint, B3OW12650  
(4 mils wet, 1.4 mils dry per coat)

C. METAL - Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous & Ornamental Iron, Sashes, Doors, Partitions, Cabinets, Lockers, Fixtures, Equipment, Copper, Non-Galvanized Metal

1. Latex Systems:

a. Semi-Gloss Finish:

1st Coat: 1st Coat: S-W Pro Industrial Pro Cryl Universal Primer B66-1310 (5.0 wet, 2.0 dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss B3IW12651 Series  
3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss B3IW12651 Series  
(4 mils wet, 1.3 mils dry per coat)

b. Flat Finish:

1st Coat: 1st Coat: S-W Pro Industrial Pro Cryl Universal Primer B66-1310 (5.0 wet, 2.0 dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Flat Wall Paint, B3OW12651  
3rd Coat: S-W ProMar 200 Latex Flat Wall Paint, B3OW12651  
(4 mils wet, 1.4 mils dry)

D. DRYWALL - (Walls, Ceilings, Gypsum Board, Etc.)

1. Latex Systems:

a. Semi-Gloss Finish:

1st Coat: S-W ProMar 200 Latex Wall Primer, B28W02600  
(4 mils wet, 1.2 mils dry)  
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B3IW02651 Series

3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B3IW02651 Series  
(4 mils wet, 1.3 mils dry per coat)

b. Egg-Shell Finish:

1st Coat: S-W ProMar 200 Latex Wall Primer, B28W02600  
(4 mils wet, 1.2 mils dry)

2nd Coat: S-W ProMar 200 Zero VOC Latex Egg-Shell, B2OW12651 Series

3rd Coat: S-W ProMar 200 Zero VOC Latex Egg-Shell, B2OW12651 Series  
(4 mils wet, 1.6 mils dry per coat)

END OF SECTION 099123

## SECTION 123554 – MANUFACTURED CASEWORK

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and provisions of the contract including General Conditions, and Division 1, apply to this section.

#### 1.02 WORK INCLUDED

- A. Furnish and install casework and accessories as shown and listed on drawings and specified herein. Include all countertops, supports, shelving, and filler panels necessary for a complete casework installation.
- B. The casework contractor shall verify all critical building dimensions prior to fabrication of casework. The casework manufacturer shall re-configure the casework arrangements to dimensions requiring 2-1/2" or less of filler at each end of wall-to-wall elevations, and to ensure a complete and satisfactory installation.
- C. Provide all labor for unloading, distribution, and installation of casework and related items as specified.

#### 1.03 WORK RELATED, NOT INCLUDED

- A. Division 6: Rough Carpentry-blocking within walls to adequately support casework. Finish Carpentry/Millwork. Architectural Woodwork.
- B. Division 7: Joint Sealants-caulking of casework and/or countertops to abutting walls.
- C. Division 22: Mechanical-furnishing, installation, and hook-up of sinks, fixtures, outlets, strainers, tailpieces, traps, vacuum breakers, stops, etc., shall be performed by the mechanical contractor to state and local codes. In all cases, sink cutouts shall be by the casework contractor. Furnishings, installation, and final connections of all ductwork to range hoods and spray booths shall be by the mechanical contractor.
- D. Division 23: The electrical contractor to state and local codes shall perform electrical furnishing, installation, and final connections of wiring, conduit, and/or electrical items within casework.

#### 1.04 MANUFACTURERS

- A. Basis of Design:  
Case Systems, Inc., 2700 James Savage Road, Midland, Michigan 48642 (989) 496-9510, [www.casesystems.com](http://www.casesystems.com) and/or its approved suppliers.
- B. Other nationally recognized casework manufacturers may be considered with written documentation stating specification compliance regarding construction, materials, and standard of quality and manufacturing techniques. Must also meet Manufacturers Capability and Manufacturers Qualifications listed below.

#### 1.05 MANUFACTURERS CAPABILITY

- A. Manufactures order entry system shall automatically download components to cutting and sizing machines such a CNC sawing and miscellaneous machining centers to control size and tolerances of component parts. Manufacturer shall have an inventory control system that includes bar coded labels to track deliverable items through the manufacturing and shipping processes to track job status and ensure complete on-time deliveries. Must have the capability to manufacture a minimum of 500 cabinets per day to ensure a complete on time delivery within a timely manner.

#### 1.06 MANUFACTURERS QUALIFICATIONS

- A. Alternate casework manufacturers requesting approval to bid shall do so in writing, listing any and all deviations to the drawings and/or specifications and provide the architect with a full-scale base cabinet not less than ten days prior to bid date. The sample shall represent typical construction and materials for the product the casework manufacturer proposes, meeting the quality standards set forth by this specification. The sample may be impounded by the owner and retained until completion of the casework installation.
- B. The casework manufacturer shall be able to offer a limited lifetime warranty to the original owner against defective material and workmanship. In addition, all non-casework items not manufactured at Case Systems, Inc. such as sinks, fixtures, apparatus, fume hoods, keyboard trays, spray booths, lights, power outlet strips, shall be covered under the original manufacturers warranty. The warranty specifically does not cover any product or hardware, which has been incorrectly installed, including poor climate conditions, exposed to excessive loads or abused.
- C. Casework manufacturer must be duly certified for premium grade from the AWI Quality Certification Program for sections 400 (Architectural Cabinets), 600 (Closet & Utility Shelving) and 1600 (Modular Cabinets).
- D. The owner, or its designated representative, reserves the right to reject any proposal that in his opinion fails to meet the criteria established by this specification. Such a decision shall be final.

#### 1.07 SUBMITTALS

- A. Catalog numbers and specifications are those of Case Systems, Inc., Midland, Michigan. The use of catalog numbers and specific requirements set forth in drawings and specifications are not intended to preclude the use of any other acceptable casework manufacturers product. Case Systems, Inc is used for the purpose of establishing quality of material, construction, and workmanship.
- B. Comply with Division 1.
- C. Product data: submit casework manufacturer's catalog showing model numbers, casework construction details, materials and hardware used.
- D. Submit color high-pressure decorative laminate brochures and edge chains samples as noted in Color Selection Section III A. and B.
- E. Submit interior samples in three colors: (Frosty White: Wilsonart 1573, Natural Almond: Wilsonart D30, Fog: Formica 961)
- F. Submit three sets of laser quality, 11" x 17" shop drawings consisting of:



1. Color and Hardware options selection sheet
2. Small scale floor plan showing casework in relation to the building
3. Large scale elevations and plan views
4. Cross-sections; service runs; blocking locations; and sink centerlines

G. Shop drawings to be submitted within 30-90 days after the notice to proceed or as specified in the general conditions of the contract documents.

#### 1.08 FINAL SHOP DRAWINGS/ORDER PROCESSING

A. The manufacturer shall make available to the architect a drawing program with the manufacturer's model numbers, available sizes and casework configurations. This same drawing program shall be used by the manufacturer for the submittal drawings to ensure consistency. The manufacturer's drawing program shall electronically download casework information into the manufacturer's order configuration to ensure the flow of accurate and timely information into their systems.

#### 1.09 PRODUCT PACKAGING/SHIPPING

- A. All casework shall be blanket wrapped for protection.
- B. Disposable packaging materials causing un-necessary debris shall not be acceptable.
- C. All products shall be direct shipped on premium air-ride furniture vans by a licensed hauler to ensure that the casework joinery is not weakened or damaged.

#### 1.10 JOB SITE CONDITIONS

- A. Ambient relative humidity must be maintained between 25 – 55% prior to delivery and throughout the life of installation.
- B. Temperature must be controlled above 55°F.
- C. Casework shall not be stored in non-climate controlled conditions.

#### 1.11 INSTALLATION

- A. See job site conditions above.
- B. Installation shall be by casework manufacturer's authorized representative.
- C. Casework shall be installed plumb and true and is to be securely anchored in place.
- D. Wall casing shall be securely anchored to horizontal wall blocking not to plaster lathe or wall board.

### PART 2 - PRODUCT CONSTRUCTION

#### 2.01 MATERIALS

- A. Core

1. Particleboard

- a. All particleboard shall be Grade M-3 Industrial, according to the American National Standard (ANSI) for Mat-Formed Wood Particleboard, ANSI-A208.1-1999 and shall meet or exceed all requirements set forth by said document.

i.	Density	40-50 lbs/cu.ft.
ii.	Moisture Content	10% Max
iii.	Modulus of Rupture	2393 psi
iv.	Modulus of Elasticity	398,900 psi
v.	Internal Bond	80 psi
vi.	Hardness	500 pounds Min
vii.	Linear Expansion	0.35%
viii.	Thickness Tolerance	+/- 0.008"
ix.	Face Screw Holding	247 pounds Min
x.	Edge Screw Holding	225 pounds Min

2. Hardboard

- a. All hardboard shall be tempered with a "S2S" surface finish and must meet or exceed the hardboard product standard ANSI-A135.5.

B. Edge Banding

1. PVC

- a. Shall be color through and be applied utilizing hot melt adhesive and radiused by automatic trimmers. Hand tool applying and trimming of edge shall not be allowed. Edging shall be available in coordinated color options.

C. Laminate

1. High-Pressure Laminate

- a. "High Pressure Laminates" shall meet the definition and performance requirements of ANSI/NEMA 3 LD – 2000. Vertical grade laminate shall be VGS balanced with a minimum grade of CLS. Countertops shall be HGS or HGP as specified.
- b. Thermally Fused Melamine Laminate
1. Thermally Fused Laminate shall meet the performance requirements of ANSI/NEMA 3 LD – 2000 for GP-28. Cabinet manufacturer shall submit panel manufacturers' current published specification stating ANSI core properties and NEMA finish properties.

c. Cabinet Liner

1. .020" thick, high- pressure cabinet liner conforming to ANSI/NEMA 3 LD – 2000, CLS. Color shall match interior, Almond, Grey, or White. Surface texture shall be similar to exterior finish.

D. Adhesives

1. PVA
  - a. Adhesive shall be mechanically applied; no contact adhesive will be permitted.
2. EVA
  - a. Adhesive shall be mechanically applied; no contact adhesive will be permitted.

## 2.02 HARDWARE

### A. Hinges

1. 5 Knuckle hinges / reveal overlay
  - a. Hinges shall be model #HH020 .095" steel five-knuckle hospital-tip institutional grade quality with .187" diameter tight pin. Residential, kitchen type pivot, plain butt, or hinges with removable pins "shall not be acceptable". Each hinge shall be secured with a minimum of nine No. 8 screws. Hinge shall permit door to swing 270 degrees without binding. Doors less than 48" in height shall have two hinges. Doors over 48" in height shall have three hinges. A minimum of three finishes shall be available. See Color Selection Section III for color information.

### B. Pulls

1. One pull shall be located at the centerline of the drawer, regardless of width, to ensure ease of operation and maximize drawer slide life. One selection from standard options per color scheme. See Color Selection Section III for color information.
  - a. DP030 plastic bow pull, 10mm diameter with 96mm O.C. mounting holes.
  - b. DP070 anodized aluminum wire pull, 8mm diameter with 96mm O.C. mounting holes.
  - c. DP080 plastic contour pull, surface mounted, 35mm x 116 mm overall size with 96mm O.C. mounting holes.

### C. Drawer Slides

1. Standard drawer: DS230 Self-closing, bottom mount epoxy coated with captive roller and positive in stop. Slide shall have 100lb. load rating, must be self-closing and must prevent drawer fronts from contacting the cabinet body.
2. File drawer: DS430 Full extension, bottom mount epoxy coated with captive roller and positive in-stop. Slide shall have 100lb. load rating, must be full extension, and prevent drawer fronts from contacting the cabinet body.

### D. MOD-EEZ™

1. All cabinet body components shall be secured utilizing concealed interlocking mechanical fasteners as approved by the Architectural Woodwork Institute Quality Standards 8<sup>th</sup> Edition – 2003 Sections 400A-T-12, 400B-T10 and 1600-T-11. The Mod-Eez™ is also an approved fastener by the Woodwork Institute "Manual of Millwork".

### E. Wall Shelving Hardware

1. Standard duty wall shelving hardware

- a. Shelving standards shall be KV800 in an anochrome finish.
  - b. Shelving brackets shall be KV810 in an anochrome finish
- 2. Heavy duty wall shelving hardware
  - a. Shelving standards shall be KV870 in an anochrome finish.
  - b. Shelving brackets shall be KV880 in an anochrome finish.

F. Shelf Clips

1. Plastic

- a. Shelf clips shall be SC240 injected molded clear plastic, with a double pin engagement 32mm on center and shall have 3/4" and 1" anti-tip locking tabs as approved in AWI 400B-T-9 for premium grade.
- b. Shelf clips shall be SC200 single pin plastic shelf clip with anti-tip locking tabs, used for all 1/4" hardboard shelves.

G. Closet rRds

- 1. 1" diameter zinc plated rod with captive sockets.

H. Locks, Model # LK010

- 1. Five disc tumbler cam locks with chrome plated steel face plate.
- 2. All locks keyed alike or keyed differently by room and master keyed. Shall permit a minimum of 166 keying options.
- 3. Lock core is removable with a control key, permitting owner to easily change lock arrangements without tools.
- 4. Inactive door of base and wall cabinets shall be secured by using an elbow catch or a chain bolt for tall cabinets.

I. Elbow Catch, Model # EC010

- 1. Chrome plated, spring loaded door catch used to hold door securely shut.

J. Roller Catch, Model # RC010 (not used with self-closing hinges)

- 1. Heavy-duty spring-loaded roller, with molded plastic bumper mounted at door top to keep door securely shut.

K. Magnetic Catch, Model # MC010 (not used with self-closing hinges)

- 1. White plastic housing with two 32mm spaced, elongated holes for screw attachment to allow adjustability.

L. Countertop Supports

- 1. Powder-coated, formed metal supports using .25" X 1.50" steel bar stock. Must provide attachment points to countertop and wall. See Color Selection Section III for color information.

2.03 CASEWORK FABRICATION

A. General Cabinet Construction

1. All structural components shall be min. 3/4" thick with balanced surfaces.
2. All fastening devices and screws shall be treated to deter or resist corrosion.
3. Mounting stretchers are 3/4" thick structural components fastened to end panels by mechanical fasteners and are concealed by the cabinet back.
4. When the rear of a cabinet is exposed, a separate finished 3/4" thick decorative laminate back panel may be applied.
5. A 5mm diameter row hole pattern 32mm (1-1/4") on center shall be bored in cabinet ends for adjustable shelves. This row hole pattern shall also serve for hardware mounting and replacement and/or relocation of cabinet components.
6. All door and drawer fronts and finished ends shall be balanced construction with "high-pressure" laminate bonded to both sides of a M-3 engineered board core.
7. Fixed interior components such as fixed shelves, dividers, and cubicle compartments shall be full 3/4" thick M-3 engineered board core attached with concealed interlocking mechanical fasteners.
8. All joints are tight fitting and will not rupture or loosen due to the following:
  - a. Dimensional changes in the engineered board.
  - b. Racking of casework during shipment and installation.
  - c. Normal use.
  - d. Seismic shock as tested and approved by the Woodwork Institute for casework used in schools and hospitals.

B. Cabinet Box

1. Each end panel to be secured with mechanical fasteners for a total tensile strength of 2,450 pounds. (excluding tall cabinets).
2. All tall cabinet end panels to be secured with mechanical fasteners for a total tensile strength of 3,850 pounds. All tall cabinets to also be provided with an intermediate fixed shelf to maintain internal dimensional stability under heavy loading conditions as well as an intermediate 3/4" thick stretcher located behind the back panel and be secured to the cabinet ends with mechanical fasteners. Where an intermediate shelf is present, the stretcher shall also be secured to the shelf with #8 x 2" plated flat head screws.
3. All base cabinets, except sink cabinets, shall have a solid 3/4" thick sub-top of M-3 engineered board core fastened to the ends with interlocking mechanical fasteners.
4. All wall cabinet bottoms shall be of 1" thick M-3 engineered board core mechanically fastened to end panels and secured to the bottom back stretcher. A lower 3/4" thick stretcher shall be located behind the back panel and attached to the end panels with mechanical fasteners. The stretcher is also secured to the cabinet bottom.
5. All sink cabinets shall incorporate a split removable back panel. A formed front brace and steel corner gussets shall be utilized to support and securely fasten top in all four corners. Front brace shall be powder coated black with attached trim, matching box edge trim color.
6. An upper 3/4" thick stretcher shall be located behind the back panel and attached to the end panels with mechanical fasteners. This stretcher is also fastened to the full sub-stop thus capturing the back panel

7. Backs, All Back Panels Shall Be:
  - a. 1/2" thick surfaced both sides for balanced construction.
  - b. Fully captured on both sides and bottom; face-mounted, stapled backs are not acceptable.
8. All exposed cabinet edges shall receive .020 PVC edging, selected from Manufacturers standard color selections

C. Base

1. Individual bases constructed of engineered board core, factory applied to base and tall cabinets shall support and carry the load of the end panels, and the cabinet bottom, directly to the floor. The base shall be let in from the sides and back of the cabinet to allow cabinets to be installed tightly together and tight against a wall. Also to conceal the top edge of applied vinyl base molding. There shall be a front to back center support for all bases over 30" wide.

D. Drawer Box

1. All drawer components shall be 1/2" thick M-3 engineered board core surfaced both sides for balanced construction.
2. Drawer box shall be constructed with a full 1/2" thick, non-racking, non-deflecting platform bottom that is carried directly by "L" shaped, bottom mount drawer glides. Sides are secured with 1-1/2" long screws driven through the platform and into the sides.
3. Sides, back, sub-front and bottom shall be 1/2" thick M-3 engineered board core surfaced both faces with (Frosty White: Wilsonart 1573, Natural Almond: Wilsonart D30, Fog: Formica 961) thermally fused melamine. The top edge shall be nominal 1mm (.020") PVC matching the drawer color.
4. Corners shall be joined with fluted hardwood dowels and glue spaced at a minimum of 32mm o/c.
5. Drawer fronts shall be removable and attached to drawer box sub-front with screws from inside of drawer.
6. Horizontal parting rails between drawers shall be 3/4" M-3 engineered board with balanced surfaces, secured to and further reinforcing cabinet ends. When drawers are keyed individually within a cabinet, or when drawers are fitted with lock hasps, the parting rail shall run full depth of cabinet to prevent pilfer.
7. Drawers with 1/4" bottoms requiring hot melt glue or intermediate supports will not be permitted. No exceptions will be permitted.
8. File drawer box shall have full height sides supporting a heavy-duty support rail for hanging file folders. Painted steel supports or metal file frames set into the drawer are not acceptable.

E. Doors and Drawer Fronts

1. Solid Doors and Drawer Front
  - a. Solid  $\frac{3}{4}$ " M-3 engineered board core with HPL front and liner back used for balanced construction and edged with 3mm PVC edge banding from manufacturers standard selections.

## 2.04 ADJUSTABLE SHELVES

### A. Laminate Shelves

1. Adjustable shelves shall be M-3 engineered board core with balanced surfaces and have a nominal 1mm (.020") thick PVC front edge.
2. Adjustable shelves 36" wide and over shall be 1" thick.
3. All adjustable shelves in open cabinets shall be 1" thick, except for special use cabinets such as mail, cubical or locker type units.
4. All other shelves shall be  $\frac{3}{4}$ " thick.

### B. Hardboard Shelves

1.  $\frac{1}{4}$ " thick tempered hardboard.
2. Powder coated in a platinum finish.
3. Solid  $\frac{3}{4}$ " M-3 engineered board core with HPL front and liner back used for balanced construction.
4. Epoxy
  - a. Epoxy Resin top shall be 1" thick with  $\frac{1}{32}$ " chamfer on finished edges and shall be provided with drip grooves on under side of finished top at exposed edges.

## 2.05 COLOR SELECTION

### A. Edge Banding

1. PVC
    - a. Thick (3mm) coordinating and contrasting edge solutions are available in many color-thru standard colors with a low gloss smooth finish.
    - b. Thin (Nominal 1mm, actual .020") coordinating and contrasting edge solutions are available in many standard colors.
- \*Reference [www.casesystems.com](http://www.casesystems.com) for the most current standard color options and closest laminate match)

### B. Laminate

1. High Pressure Laminate is available in non-premium, non-specialty and manufacturers' standard suede finishes from our select laminate manufacturers, including WilsonArt® in a "60" matte finish, Formica® in a "58" matte finish, Nevamar® in a "T" textured finish and Pionite® in a "S" suede finish. Specialty and other manufacturer finishes are available with additional cost and longer lead times.
2. Thermally Fused Melamine Laminate available in Natural Almond (WilsonArt D30), Fog (Formica 961) and Frosty White (Wilsonart 1573) for the standard interior cabinet surface at no up-charge. Fusion Maple (WilsonArt 7909), Oiled Cherry (Pionite WC421) and Golden Oak (WilsonArt 7888) may also be specified, but will result in additional cost when used on standard casework. Library cabinets are priced to include the added cost of the wood grain thermally fused material and therefore do not get an up-charge.

C. Misc. Hardware

1. Table Frames
  - a. Available in light beige, grey or black
2. Countertop Support
  - a. X0500 Support available in grey, light beige, black and white
3. Pulls
  - a. DP030 Plastic wire pull available in white, light beige, greystone, surf white, haze, clay, taupe, black, hunter green, slate grey, burgundy, platinum, victorian teal, shadow blue, brittany blue, pepperdust, mauve blush, or marine blue.
  - b. DP070 Clear anodized aluminum wire pull.
  - c. DP080 Plastic contour pull available in almond, grey, black and white.
4. Hinges
  - a. HH020 5 Knuckle hinge are available in black, almond and platinum in an epoxy powder coat.
5. Grommets
  - a. GR650 Paper grommet is available in black.
  - b. GR660 Round grommet is available in black, almond, grey or white.
  - c. GR620 Oval grommet is available in black.

## PART 3 - PRODUCT QUALITY TESTING

### 3.01 CABINET JOINERY

#### A. Base Cabinet



1. Base cabinet testing shall be done in accordance with SEFA 8PL Recommended Practices Paragraph 4.0 Base Cabinets. All testing shall be performed by SEFA certified independent testing facilities. The following tests shall be performed:

- a. The SEFA test procedures are accessible on-line at [www.sefalabs.com](http://www.sefalabs.com)  
The ANSI/NEMA 3 LD – 2000 test procedures are available on-line at [www.global.ihs.com](http://www.global.ihs.com)

(1) Test	Paragraph
(2) Cabinet Load	4.2
(3) Cabinet Concentrated Load	4.3
(4) Cabinet Torsion	4.4
(5) Cabinet Submersion	4.5

B. Doors

1. Door testing shall be done in accordance with SEFA 8PL Recommended Practices Paragraph 5.0 Doors. The following tests shall be performed:

(1) Test	Paragraph
(2) Door Hinge Test	5.1
(3) Door Cycle Test	5.2

C. Drawers

1. Drawer testing shall be done in accordance with SEFA 8PL Recommended Practices Paragraph 6.0 Drawers. The following tests shall be performed:

(1) Test	Paragraph
(2) Drawer Static Test	6.1
(3) Drawer Impact Test	6.2
(4) Drawer Internal Rolling Test	6.3
(5) Drawer Cycle Test	6.4

D. Cabinet Surface Finish

1. Cabinet surface finish tests shall be done in accordance with SEFA 8PL Recommended Practices Paragraph 8.0, Cabinet Surface Finish Tests. The following testing shall be performed:

(1) Test	Paragraph
(2) Chemical Spot Test	8.1
(3) Boiling Water Resistance Test (ANSI/NEMA LD 3 -2000 Paragraph 3.5)	8.2
(4) Ball Impact Resistance Test (ANSI/NEMA LD 3 -2000 Paragraph 3.8)	8.3
(5) Dart Impact resistance Test (ANSI/NEMA LD 3 – 2000 Paragraph 3.9)	8.4

E. Edge Delaminating Test

1. Edge delaminating tests shall be done in accordance with SEFA 8PL Recommended Practices Paragraph 8.5, Edge Delaminating Test.

F. Plastic Laminate Abrasion Test

1. Plastic laminate abrasion tests shall be done in accordance with SEFA 8PL Recommended Practices Paragraph 8.7 Plastic Laminate Abrasion Test (ANSI/NEAM LD 3 – 2000 Paragraph 3.13).

G. Wall, Counter Mounted, and Tall Cabinets Load test

1. The wall mounted cabinet load test shall be done in accordance with SEFA 8PL Recommended Practices Paragraph 9.0.

END SECTION 123554

## SECTION 133419 - METAL BUILDING SYSTEMS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Metal Framing Components.
- B. Metal Wall Panels and Trim.
- C. Metal Roof Panels and Trim.
- D. Metal Building Accessories

#### 1.2 RELATED SECTIONS

- A. Section 03 30 00- Cast-in-place concrete.
- B. Section 08 36 00 – Sectional Overhead doors.
- C. Section 08 51 13 – Aluminum Windows.
- D. Section 09 91 23 – Interior Painting

#### 1.3 REFERENCE STANDARDS

- A. American Institute of Steel Construction (AISC):
  - 1. AISC Specification for Structural Steel Buildings.
  - 2. AISC Serviceability Design Considerations for Low-Rise Buildings
- B. American Iron and Steel Institute (AISI):
  - 1. AISI North American Specification for the Design of Cold-Formed Steel Structural Members
- C. American Welding Society (AWS):
  - 1. AWS D1.1 / D1.1M – Structural Welding Code – Steel.
  - 2. AWS D1.3 / D1.3M – Structural Welding Code – Sheet Steel
- D. Association for Iron & Steel Technology (AISE):
  - 1. AISE 13 – Specifications for Design and Construction of Mill Buildings.
- E. ASTM International (ASTM):
  - 1. ASTM A 36 – Standard Specification for Carbon Structural Steel
  - 2. ASTM A 48 – Specification for Gray Iron Castings
  - 3. ASTM A 123 – Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - 4. ASTM A 307 – Specification for Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength
  - 5. ASTM A 325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
  - 6. ASTM A 354 – Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners

7. ASTM A 475 – Specification for Zinc-Coated Steel Wire Strand
8. ASTM A 490 – Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
9. ASTM A 500 – Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
10. ASTM A 529 – Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
11. ASTM A 563 – Specification for Carbon and Alloy Steel Nuts
12. ASTM A 572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
13. ASTM A 653 / A 653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
14. ASTM A 792 / A 792M – Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
15. ASTM A 992 – Standard Specification for Structural Steel Shapes.
16. ASTM A 1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
17. ASTM A 1039 – Specification for Steel, Sheet, Hot Rolled, Carbon, Commercial, Structural, and High-Strength Low-Alloy, Produced by Twin-Roll Casting Process
18. ASTM E 96 / E 96M – Standard Test Methods for Water Vapor Transmission of Materials.
19. ASTM E 108—Spread-of Flame Testing: Class 1A Rating.
20. ASTM E 283 – Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
21. ASTM E 331 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
22. ASTM E 1592 – Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
23. ASTM E 1646 – Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
24. ASTM E 1680 – Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems
25. ASTM E 2140 – Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head
26. ASTM F 436 – Specification for Hardened Steel Washers
27. ASTM F 1145 – Specification for Turnbuckles, Swaged, Welded, Forged
28. ASTM F 1554 – Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

F. CSA – Canadian Standards Association

G. CWB – Canadian Welding Bureau

H. IAS – International Accreditation Service

I. LGSI – Light Gauge Steel Institute

J. SJI – Steel Joist Institute

K. Florida Product Approval:

1. Nucor CFR approved under file number FL4891.

L. FM Global:

1. FMRC Standard 4471 – Approval Standard for Class 1 Roofs for Hail Damage Resistance, Combustibility, and Wind Uplift Resistance.

- M. Metal Building Manufacturers Association (MBMA):
  - 1. MBMA Metal Building Systems Manual.
- N. Underwriters Laboratories (UL):
  - 1. UL 580 – Standard for Tests for Uplift Resistance of Roof Assemblies.

#### 1.4 DEFINITIONS

- A. Metal Building System: A building system that will employ:
  - Either continuous or simple-span 'Z' or 'C'-shaped cold-formed purlins or open-web steel joists for support of the roof cladding.
  - Simple-span 'Z' or 'C'-shaped cold-formed purlins or open-web steel joists for support of the steel wall cladding.
  - Three-plate, built-up rigid space frames and/or cold-formed 'C' or hot-rolled I-shaped post-and-beam framing to support the roof and wall secondary members.
  - All systems (cladding, roof and wall secondary, lateral primary framing, and longitudinal bracing) work together to provide resistance to vertical and lateral loading demands.
- B. Single-Slope: A continuous frame building which does not contain a ridge but consists of one continuous slope from side to side. The building consists of straight or tapered columns and tapered or straight rafters. The sidewall girts may be continuous (by-passing the columns) or simple span (flush in the column line). The rafters may or may not have interior columns.
- C. Roof Slope: Pitch expressed as inches of rise for each 12" of horizontal run.
- D. Building Width: Measured from outside to outside of sidewall secondary structural member (girt).
- E. Building Eave Height: A nominal dimension measured from the finished floor to top flange of eave strut.
- F. Building Length: Measured from outside to outside of endwall secondary structural member.
- G. Auxiliary Loads: Dynamic loads induced by cranes, conveyors, or other material handling systems.
- H. Collateral Loads: The weight of any non-moving equipment or material, such as ceilings, electrical or mechanical equipment, sprinkler systems, plumbing, or ceilings.
- I. Dead Load: The actual weight of the building system (as provided by the metal building supplier) supported by a given member.
- J. Floor Live Loads: Loads induced on a floor system by occupants of a building and their furniture, equipment, etc.
- K. Roof Live Loads: Loads produced by maintenance activities, rain, erection activities, and other movable or moving loads but not including wind, snow, seismic, crane, or dead loads.
- L. Roof Snow Loads: Gravity load induced by the weight of snow or ice on the roof, assumed to act on the horizontal projection of the roof.
- M. Seismic Loads: Loads acting in any direction on a structural system due to the action of an earthquake.

- N. Wind Loads: The loads on a structure induced by the forces of wind blowing from any horizontal direction.

## 1.5 DESIGN REQUIREMENTS

### A. General

1. The building manufacturer will use standards, specifications, recommendations, findings and/or interpretations of professionally-recognized groups such as AISC, AISI, AWS, ASTM, CSA, CWB, MBMA, Federal Specifications, and unpublished research by MBMA as the basis for establishing design, drafting, fabrication, and quality criteria, practices, and tolerances. The Manufacturer's design, drafting, fabrication and quality criteria, practices, and tolerances shall govern, unless specifically countermanded by the contract documents.
2. Design structural mill sections and built-up plate sections in accordance with:
  - a. Code-appropriate edition of AISC's "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings", ANSI/AISC 360 ASD method.
3. Cold-Formed steel structural members and panels will generally be designed in accordance with "Specifications for the Design of Cold-Formed Steel Structural Members", 2007 Edition, ANSI/AISI S-100-07 or CAN CSA S136-07.
4. Design weldments per the following:
  - a. Structural Welding
    - 1) Design per AWS D1.1, "Structural Welding Code – Steel", Latest Edition.
  - b. Cold-Formed Welding
    - 1) Design per AWS D1.3, "Structural Welding Code – Sheet Steel", Latest Edition.

### B. Design Code:

1. Structural design for the building structural system shall be provided by the metal building system manufacturer for the following design criteria:
  - a. Governing Building Code: Building Code of New York State.
  - b. Year/Version: 2020.
  - c. Occupancy Category: S-2.

### C. Design Loads:

1. Dead Load – Weight of the building system as determined by manufacturer.
2. Roof Live Load – 20\_\_\_\_\_.
3. Collateral Load – Refer to mechanical sheet M6.01\_\_\_\_\_.
4. Roof Snow Load:
  - a. Ground Snow Load – 30 psf\_\_\_\_\_.
  - b. Snow Exposure Coefficient (Ce) – 1.0\_\_\_\_\_.
  - c. Thermal Coefficient (Ct) – 1.0\_\_\_\_\_.
  - d. Roof Snow Load – 21 psf\_\_\_\_\_.
5. Wind Load:
  - a. Wind Speed – 115\_\_\_\_\_.
  - b. Wind Exposure – B
6. Seismic Load:
  - a. Spectral response acceleration for short periods (Ss) – 268\_\_\_\_\_.
  - b. Spectral response acceleration for 1-sec. period (S1) – .072\_\_\_\_\_.
  - c. Site Class – C\_\_\_\_\_.
7. Auxiliary Loads: Auxiliary loads shall include dynamic loads, such as cranes and material handling systems, and will be defined in the Contract Documents.

### D. General Serviceability Limits :

1. Deflection Limits shall be in accordance with the applicable provisions of the Metal Building Systems Manual (MBMA), latest edition.

2. Vertical Deflections:
  - a. Roof Secondary (Purlins) – L/150.
  - b. Main Frame roof beams – L/180.
3. Horizontal Deflections:
  - a. Wall Secondary (Girts) – L/90.
  - b. Main Frames – H/60.
4. Vertical deflection limits apply for snow load (50-year mean-recurrence interval) plus collateral load, or the code required live load. The horizontal drift and deflections limits apply for the loads induced by a basic wind speed corresponding to a 10 year mean-recurrence interval.

## 1.6 SUBMITTALS

- A. Submit under provisions of Section 013300 "Submittal Procedures".
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  1. Preparation instructions and recommendations.
  2. Storage and handling requirements and recommendations.
  3. Installation methods.
- C. Shop Drawings: Provide complete erection drawings for the proper identification and assembly of all building components. Drawings will show anchor bolt settings, transverse cross-sections, sidewall, endwall and roof framing, flashing and sheeting, and accessory installation details.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, representing actual product, color, and patterns.
- F. Certifications: Metal Building Manufacturers Shop Drawings and design analysis/calculations shall be stamped with seal by a New York State registered engineer. Contractor required to submit these stamped items for final approval.
- G. Bill of Materials: Bills of material shall be furnished and shall include item weights.
- H. Preventative Maintenance Manual.
- I. Welder's Certifications: Certification of welder qualifications shall be furnished as specified by the Project Engineer.
- J. Submit certification verifying that the metal standing seam roof system has been tested in accordance with ASTM E 1592 test protocols.

## 1.7 QUALITY ASSURANCE

- A. Manufacturer / Fabricator Qualifications:
  1. All primary products specified in this section will be supplied by a single IAS AC 472 Accredited Manufacturer /Fabricator with a minimum of five (5) years' experience.
- B. Weldments/Welder/Weld Inspection Qualifications:

1. Welding inspection and welding inspector qualification for structural steel shall be in accordance with AWS D1.1, "Structural Welding Code – Steel", latest edition. Welding inspection and welding inspector qualification for cold-formed steel shall be in accordance with AWS D1.3, "Structural Welding Code – Sheet Steel", latest edition.
- C. Erector Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.
- D. Design: Standard drawings and design analysis must bear the seal of a registered professional engineer. Design analysis must be on file and furnished by manufacturer upon request.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage and Handling Requirements:
  1. Store and handle materials in accordance with manufacturer's instructions.
  2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
  3. Do not store materials directly on ground.
  4. Store materials on flat, level surface, raised above ground, with adequate support to prevent sagging.
  5. Protect materials and finish during storage, handling, and installation to prevent damage.
- C. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- D. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

#### 1.9 WARRANTY

- A. Building System Warranty
  1. Furnish manufacturer's standard warranty for the metal building system, excluding paint.
  2. The manufacturer shall warranty the metal building system against failure due to defective material or workmanship for a period of one (1) year from date of shipment.
  3. The liability under this warranty shall be limited to furnishing, but not dismantling or installing, necessary replacement material F.O.B. manufacturer's plant. In no event shall the manufacturer be liable for loss of profits, or other incidental, consequential, or special damages.
- B. Standing Seam Roof Weathertightness Warranty
  1. Furnish manufacturer's weathertightness warranty for a maximum of 20 years against leaks in standing seam roof panels, arising out of or caused by ordinary wear and tear under normal weather and atmospheric conditions.
- C. Roof and Wall Paint Finish Warranty
  1. Paint Systems



- a. Furnish manufacturer's standard warranty for the metal panel paint system against chipping, peeling, blistering, fading in excess of 5 NBS Hunter units as set forth in ASTM-D-2244, and chalking in excess of 8 units as set forth in ASTM-D-4214.
  - b. The warranty shall be for a period of 30 years from the date of shipment for PVDF paint systems.
  - c. The warranty shall be for a period of 25 years from the date of shipment for silicone-polyester paint systems.
- 2. Galvalume® systems
  - a. Furnish manufacturer's standard warranty for the Galvalume® panels against rupture, structural failure, or perforation due to normal atmospheric conditions.
  - b. The warranty shall be for a period of 20 years from the date of shipment for Galvalume® systems.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Nucor Building Systems; <http://www.nucorbuildingsystems.com>
- B. Substitutions: Reference Specification Section 012500 "Substitution Procedures".

### 2.2 MATERIALS

- A. Primary Framing Steel:
  - 1. Steel for hot rolled shapes must conform to the requirements of ASTM Specifications A-36, A-572 or A-992, with minimum yield of 36 or 50 ksi, respectively.
  - 2. Steel for built-up sections must conform to the requirements of ASTM A-1011, A-1018, A-529, A-572 or A-36 as applicable, with minimum yield of 42, 46, 50, or 55 ksi as indicated by the design requirements.
  - 3. Steel for Cold-Formed Endwall "C" sections must conform to the requirements of ASTM A-1011 or A-1039 Grade 55, or ASTM A-653 Grade 55 with minimum yield strength of 55 ksi.
  - 4. X-bracing will conform to ASTM A-36 or ASTM A-529 for rod and angle bracing or ASTM A-475 for cable bracing.
- B. Secondary Framing Steel:
  - 1. Steel used to form purlins, girts and eave struts must meet the requirements of ASTM A-1011 or ASTM A-1039 Grade 55 for primed material or ASTM A-653 Grade 55 for galvanized material with a minimum yield of 55 ksi.
  - 2. Design Thicknesses – Gauge to be determined by design to meet specified loading conditions.
- C. Panels:
  - 1. Roll-formed Galvalume®, pre-painted Galvalume® or Galvanized G90 Exterior-Side and G60 Interior-Side. In Canada, Galvanized panel will have a coating thickness of G90 on both sides.
  - 2. Standing Seam Panels must have:
    - a. 50 percent minimum aluminum-zinc alloy- coating and conform to ASTM A-792 or ASTM A-653 with a minimum yield of 50 ksi.
  - 3. Through-fastened panels must have:

- a. 50 percent minimum aluminum-zinc alloy coating and conform to ASTM A-792 or ASTM A-653 with a minimum yield of 50 ksi.
- 4. Panel Finish:
  - a. SP Finish: Modified Siliconized Polyester paint system with a 25-year finish warranty.
  - b. PVDF Finish: 70% PVDF paint system with a 30-year finish warranty.
- D. Panel Fasteners:
  - 1. For Galvalume® and Painted finished roof panels: Long Life Cast Zinc head.
  - 2. For wall panels: Coated carbon steel.
  - 3. Color of exposed fastener heads to match the wall and roof panel finish.
  - 4. Concealed Fasteners: Self-drilling type, of size required.
- E. Flashing and Trim: Match material, finish, and color of adjacent components. Provide trim at rakes, including peak and corner assemblies, high and low eaves, corners, bases, framed openings and as required or specified to provide weathertightness and a finished appearance.
- F. Roof Clips:
  - 1. All clips must have factory-applied mastic and designed so that movement between the panel and the clip does not occur.
  - 2. Short or Tall Fixed clips; shall be either 3 ½ inches (89mm) or 4 ½ inches (114mm) in height. Used for applications where only a moderate amount of thermal expansion and contraction in the roof panel is expected.
  - 3. Short or Tall Sliding clips: shall be either 3 ½ inches (89mm) or 4 ½ inches (114mm) in height and provide either 1-7/8 inches or 3 7/8 inches of travel for panel thermal expansion and contraction, depending on clip choice.
- G. Sealant and Closures:
  - 1. Sidelaps: Factory applied non-skinning Butyl mastic.
  - 2. Endlaps, Eave, Ridge Assembly, and Gable Flashings: Field applied 100% solids butyl-based elastomeric tape sealant, furnished in pre-cut lengths.
  - 3. Outside Closures: Closed-cell, plastic or metal
  - 4. Inside Closures: Closed-cell, plastic or metal

## 2.3 PRIMARY FRAMING

- A. Rigid Frames: Fabricated as welded built-up "I" sections or hot-rolled sections.
  - 1. Frame Design: Single Slope.
- B. Rigid Frame Columns:
  - 1. Straight/Uniform depth
  - 2. Tapered
- C. Rigid Frame Rafters:
  - 1. Straight/Uniform depth
  - 2. Tapered
- D. Endwall Frames / Roof Beams: Fabricated as mill-rolled sections or built-up "I" sections depending on design requirements. Fabricate endwall columns of cold-formed "C" sections, mill-rolled sections, or built-up "I" sections depending on design requirements.

- E. Interior Columns: Columns supporting rafters of mainframes shall be of the following cross-section type(s):
  - 1. Pipe (Round HSS).
  - 2. Tube (Square HSS).
  - 3. "I"-Shaped (Built-Up or Mill-Rolled depending on design requirements).
- F. Finish: Red-Oxide or Gray Primer, or galvanized (pre coated galvanized cold-form, hot-dipped otherwise).
- G. Field Bolted Connections: All field bolted connections shall be designed and detailed utilizing ASTM A-325 or A-490 depending on design requirement.

## 2.4 SECONDARY FRAMING

- A. Purlins and Girts: Purlins and girts shall be cold-formed "Z" sections with stiffened flanges. Flange stiffeners shall be sized to comply with the requirements of the latest edition of AISI and LGSI. They shall be pre-punched at the factory to provide for field bolting to the rigid frames. They shall be simple or continuous span as required by design. Connection bolts will install through the purlin/girt webs, not purlin/girt flanges.
- B. Purlins (Excluding Open Web Joists): Horizontal structural members which support roof coverings.
  - 1. Depth: 8"
  - 2. Maximum Length: To be determined by design.
  - 3. Finish: Red Oxide Primer.
- C. Girts: Horizontal structural members that support vertical panels.
  - 1. Depth: To be determined by design 8"
  - 2. Maximum Length: To be determined by design.
  - 3. Finish: Red Oxide Primer.
- D. Eave Struts: Unequal flange, cold-formed "Z" purlins.
  - 1. Depth: To be determined by design 8"
  - 2. Maximum Length: To be determined by design.
  - 3. Finish: Red Oxide Primer.
- E. Base Framing: Base members to which the base of the wall covering may be attached to the perimeter of the slab. Secured to the concrete slab with mechanical anchors.
  - 1. Formed base sill.
  - 2. Base angle.
    - a. With flashing.
  - 3. Finish: Red Oxide Primer.
- F. Nucor Building Systems roof joist system.
  - 1. Open web, parallel chord, simple span load carrying members suitable for the direct support of roof systems utilizing material sizes and yield strengths as required.
  - 2. ClearBay™ roof joist system with reduced bridging on qualified "CFR" projects.
  - 3. Bridging
    - a. All Bolted
  - 4. Joist attachment
    - a. All Bolted (No welding required)
    - b. Alt. Bolted (Some welding required)

5. Open web members shall be fabricated of material that conforms to the material specifications designated by the Steel Joist Institute as acceptable for this product.

## 2.5 ROOF PANELS

- A. Nucor CFR Roof™ Panel: A mechanically seamed trapezoidal standing seam roof panel with concealed clips. Installed directly over purlins. Tested in accordance with ASTM E 1646 and E 1680 for water penetration and air infiltration, and per ASTM E1592 for wind uplift capacity.
  1. Gauge: 24 (Std.).
  2. Dimensions: 24 inches (610mm) wide by 3 inches (76mm) high.
  3. Clips: Tall Fixed.
  4. Clips: Tall Sliding.
  5. Finish/Color: As specified in Article 2.8 PANEL FINISH.

## 2.6 WALL PANELS

- A. Nucor Classic™ Wall Panel: A through-fastened sidewall panel with 1 1/4 inch (32mm) ribs at 12 inches (305mm) on center. The area between the ribs is reinforced to minimize oil-canning.
  1. Gauge: 26 (Std.).
  2. Dimensions: 36 inches (915mm) wide by 1 1/4 inch (32mm) high.
  3. Finish/Color: As specified in Article 2.8 PANEL FINISH.

## 2.7 ACCESSORIES

- A. Canopies: Overhanging or projecting roof structures off the sidewall or endwall with the extreme end usually unsupported. For aesthetic application or to cover entrance or walkway.
- B. Roof Line Trim:
  1. Trim Type: Simple Eave/Rake Trim.
  2. Trim Type: Low-Eave Gutter / Sculptured Rake Trim.
- C. Framed Openings: Used to frame out doors, windows, louvers, and any other openings. Refers to the framing members and flashing which surround an opening and includes jambs, header and or sill, trim, and fasteners.
- D. Walk Doors: Personnel entry doors.
  1. Size: As noted on the Contract Drawings.
  2. Accessories: As noted on the Contract Drawings
  3. Size: 3 foot by 7 foot (914x2133mm) Single Leaf.
- E. Windows: Self-flashing, self-framing horizontal slide or fixed narrow-lite windows.
  1. Type / Size: As noted on the Contract Drawings.
- F. Liner Panels: Nucor Classic™ Liner Panel: A through-fastened sidewall panel with 1 1/4 inch (32mm) ribs at 12 inches (305mm) on center. The area between the ribs is reinforced to minimize oil-canning.
  1. Gauge: 26.
  2. Dimensions: 36 inches (915mm) wide by 1 1/4 inch (32mm) high.
  3. Finish: As specified in Article 2.8 PANEL FINISHES.
- G. Soffit Panels:

1. Nucor Classic™ Wall Panel: A through-fastened sidewall panel with 1 1/4 inch (32mm) ribs at 12 inches (305mm) on center. The area between the ribs is reinforced to minimize oil-canning.
  - a. 343419Gauge: 24.
  - b. Dimensions: 36 inches (915mm) wide by 1 1/4 inch (32mm) high.
  - c. Finish: As specified in Article 2.8 PANEL FINISHES.
  
- H. Partitions: Interior or exterior walls that are inside the building footprint to section off parts of the interior space of a building.
  
- I. Valley Gutter: Gutter used to carry off water from attached buildings or multi-gabled buildings. Standard valley gutter is 14 gauge pre-galvanized 10 foot (3048mm) sections, field welded in place (gutter liner and drainage members by others).
  
- J. Roof Vents: Accessories used on the roof to allow air to pass through.
  1. Gravity Ridge Vents: Can be used as single unit or continuous.
    - a. Size: 9 inch by 10 foot (229x3048mm) with Damper & Lockerpull.
  
- K. Pipe Flashings: Aluminum base with EPDM boot. The base flange must bend to form a seal with surface irregularities or roof pitch.
  1. Size: 1/4" to 4" (6 to 102mm) Pipe

## 2.8 PANEL FINISHES

### A. Roof Panel:

1. Nucor PVDF Panel Paint System (PVDF Resin, 30-year Finish Warranty):
  - a. Color: Dark Bronze (DB)
  - b. Color: Cypress Green (CY)
  - c. Color: Royal Blue (RO)
  - d. Color: Terra Cotta (TC)
  - e. Color: Surrey Beige (SU)
  - f. Color: Medium Gray (MG)
  - g. Color: Warm White (WW)
  - h. Color: Regal White (RW)

### B. Wall Panel:

1. Nucor PVDF Panel Paint System (PVDF Resin, 30-year Finish Warranty):
  - a. Color: Dark Bronze (DB)
  - b. Color: Cypress Green (CY)
  - c. Color: Royal Blue (RO)
  - d. Color: Terra Cotta (TC)
  - e. Color: Surrey Beige (SU)
  - f. Color: Medium Gray (MG)
  - g. Color: Warm White (WW)
  - h. Color: Regal White (RW)
  
2. Interior panel:
  - a. Nucor Standard Panel Paint System (Siliconized Polyester Resin, 25-year Finish Warranty):
    - 1) Imperial White

- C. Liner Panel:
  - 1. Nucor Standard Panel Paint System (Siliconized Polyester Resin, 25-year Finish Warranty):
    - a. 28 gauge:
      - 1) Color: Polar White (PW)
    - b. 26 gauge:
      - 1) Color: Aztec Blue (AB)
- D. Soffit Panel:
  - 1. Nucor Standard Panel Paint System (Siliconized Polyester Resin, 25-year Finish Warranty):
    - a. Color: Aztec Blue (AB)

## 2.9 FABRICATION

- A. General:
  - 1. Shop-fabricate all framing members for field bolted assembly. The surfaces of the bolted connections must be smooth and free from burrs or distortions.
  - 2. Shop connections must conform to the manufacturer's standard design practices as defined in this section. Certification of welder qualifications will be furnished when required and specified in advance.
  - 3. All framing members must carry an identifying mark.
- B. Primary Framing:
  - 1. Plates, Stiffeners and Related Members.: Factory weld base plates splice plates, cap plates, and stiffeners into place on the structural members.
  - 2. Bolt Holes and Related Machining: Shop fabricate base plates, splices and flanges to include bolt connection holes. Shop fabricated webs to include bracing holes.
  - 3. Secondary structural connections (purlins and girts) to be ordinary bolted connections, which may include welded clips.
  - 4. Manufacturer is responsible for all welding inspection in accordance with the manufacturer's IAS Accreditation or CAN/CSA A660 Certification. Special inspection by the buyer or owner may be done in the manufacturer's facility and must be noted on the Contract Documents.
  - 5. Non-Destructive Testing (NDT) - NDT shall be performed and documented as required by the governing building code for this project.
- C. Open-Web Roof Joists:
  - 1. Purlins for 'long-bay' building layouts shall consist of open-web bar joists designed under Steel Joist Institute (SJI) specifications by an SJI-Certified Joist Manufacturer for the prescribed loads.
  - 2. The Nucor ClearBay™ Joist system includes joist bridging and joist-seat-to-supporting structural connections using 3/8" diameter self-drilling bolts made from ASTM A354 Grade BD steel.
  - 3. Field welding of joist bridging and seats is an alternative method for connection of joists to supporting primary structural members.
- D. Zee Purlins:
  - 1. Fabricate purlins from cold-formed "Z" sections with stiffened flanges. Size flange stiffeners to comply with the requirements of the latest edition of AISI. Connection bolts will install through the webs, not the flanges.

- E. Girts

1. Girts must be simple or continuous span as required by design. Connection bolts will install through the webs, not the flanges.

F. Bracing:

1. Diagonal Bracing:
  - a. Wind bracing in the roof and/or walls need not be furnished where it can be shown that the diaphragm strength of the roof and/or wall covering is adequate to resist the applied wind or seismic forces. Diagonal bracing in the roof and sidewalls may be used to resist longitudinal loads (wind, crane, etc.) in the structure if diaphragm action cannot be used.
  - b. Diagonal bracing will be furnished to length and equipped with hillside washers and nuts at each end. It may consist of rods threaded each end or galvanized cable with suitable threaded end anchors. If load requirements so dictate, bracing may be of structural angle and/or pipe, bolted in place.
2. Special Bracing: When diagonal bracing is not permitted in the sidewall, a rigid frame type portal or fixed base column will be used. Shear walls can also be used where adequate to resist the applied wind or seismic forces.
3. Flange Braces: The compression flange of all primary framing must be braced laterally with angles connecting to the bottoms chords of purlins or to the webs of girts so that the flange compressive stress is within allowable limits for any combination of loading.
4. Bridging:
  - a. Laterally bridge the top and bottom chords of the open-web bar joists as required by design thereof and specified on the building erection drawings.

G. Standing Seam Panels - General:

1. One side of the panel is configured as female, having factory applied hot-melt mastic inside the female seam. The female side will hook over the male side and when seamed creates a continuous lock, forming a weathertight seam.
2. Panels are factory notched at both ends so that field installation can commence or terminate from either end of the building. Panels cannot start at both ends of the building and work towards each other.
3. Maximum panel length is 55 feet (16,764mm) unless otherwise noted in the Contract Documents.
4. Endlaps:
  - a. Endlaps must have a 16 gauge backup plate and have the four endlap joint fasteners installed in four pre-punched holes in the flat.
  - b. Apply mastic between the panels and secured with #17-14 x 1 1/4 inch (32mm) self-tapping fasteners through the panels, and backup plate to form a compression joint.
  - c. "Through-the-Roof" fasteners may only be used at endlaps and eaves.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

- B. Before erection proceeds, survey elevations and locations of concrete and masonry bearing surfaces and locations of anchor rods, bearing plates and other embedment's to receive structural framing, with Erector present, for compliance with requirements and metal building system manufacturer's tolerances.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads equal in intensity to design loads. Remove temporary supports when permanent structural framing connections and bracing are in place, unless otherwise indicated.

### 3.3 INSTALLATION

- A. The erection of the building system shall be performed by a qualified erector, in accordance with the appropriate erection drawings, erection guides and /or other documents furnished by manufacturer, using proper tools, equipment and safety practices.
- B. Erection practices shall conform to "Common Industry Practices", Section 6, MBMA (LR)-Building Systems Manual.
- C. There shall be no field modifications to primary structural members except as authorized and specified by manufacturer.

### 3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 133419



## SECTION 220000 - PLUMBING SUMMARY OF WORK

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 22, and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Work covered under Plumbing contract.
  - 2. Work under other contracts.
  - 3. Use of premises.
  - 4. Owner's occupancy requirements.
  - 5. Specification formats and conventions.
- B. Related Sections include the following:
  - 1. Division 22 Sections.

#### 1.3 WORK COVERED UNDER PLUMBING CONTRACT

- A. Provide all labor, materials, tools, machinery, equipment, and services necessary to complete the plumbing work under this contract. All systems and equipment shall be complete in every respect and all items of material, equipment, and labor shall be provided for a fully operational system. Coordinate the work with work of other trades so as to resolve conflicts without impeding job progress. The plumbing work includes the following:
- B. The plumbing contractor shall furnish all labor, materials, equipment, rigging, appliances, tools and accessories required for providing, installing, connecting and testing the new plumbing system, associated work, controls etc., in accordance with these specifications and the applicable drawings. The work includes:
  - 1. Furnish and install new domestic hot water heaters as indicated on plumbing drawings complete with wall mounted support/drain pan, hot and cold water piping, drain piping, valves, gauges, insulation, electricals, controls, gas piping (where indicated) circulator pumps, supports, identification tags, and connection to existing system for a complete operating system.
  - 2. Furnish and install hot and cold domestic water piping with domestic hot water return piping.
  - 3. Furnish and install new drain, waste, and vent pipes and floor drains. Coordinate all slopes and inverts.
  - 4. Furnish and install new plumbing fixtures, valves, strainers, cleanouts, accessories, etc. as specified on the drawings and in the specifications.

5. Provide new gas lines to all gas fired HV/HVAC equipment, as called out on the drawings. Coordinate installation with local gas provider. Contractor to arrange with local gas provider to bring new gas service to the building. Pay for all permits and fees.
6. Provide insulation for all domestic cold water, domestic hot water, domestic hot water return, storm piping, and roof drain pans. Insulation shall be continuous for the entire length of the pipe and provided with high density insulation at hangers and supports with shields at hangers.
7. Provide identification tags for all piping.
8. Provide proper piping supports, hangers, anchors, spring isolation hangers, etc.
9. Provide proper slope to all piping as per National Standard Plumbing Code and other applicable codes.
10. Pressure test all piping for any leakage. Provide pressure test reports (six (6) copies) to the Owner/Architect for review.
11. Paint all non-insulated piping. New exterior gas piping shall be painted yellow.
12. Provide backflow preventers, shut-off valves, pressure reducing valves, relief valves, etc. for cold water piping connections to heating equipment as per local building codes.
13. Provide gas pressure regulators for all appliances and heating equipment connected to gas piping.

#### 1.4 WORK UNDER OTHER CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

#### 1.5 USE OF PREMISES

- A. General: Each Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.
- B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  1. Owner Occupancy: Allow for Owner occupancy of Project site and use by the public.
  2. Driveways and Entrances: Keep driveways parking garage, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Use of Existing Building: Maintain existing building in a weather tight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

#### 1.6 OWNER'S OCCUPANCY REQUIREMENTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction.

- B. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits, unless otherwise indicated.
  - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
  - 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- C. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
  - 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
  - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
  - 3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed.

## 1.7 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the CSI/CSC's "MasterFormat" numbering system.
  - 1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
  - 2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
  - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
    - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 220000

## SECTION 220501 - BASIC PLUMBING MATERIALS AND METHODS

### 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. Piping materials and installation instructions common to most piping systems.
  - 2. Transition fittings.
  - 3. Dielectric fittings.
  - 4. Mechanical sleeve seals.
  - 5. Sleeves.
  - 6. Escutcheons.
  - 7. Grout.
  - 8. Equipment installation requirements common to equipment sections.
  - 9. Painting and finishing.
  - 10. Supports and anchorages.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
  - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
  - 2. CPVC: Chlorinated polyvinyl chloride plastic.
  - 3. PE: Polyethylene plastic.
  - 4. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

#### 1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

#### 1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for 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, the manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

### 2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
  - 1. Manufacturers:
    - a. Eclipse, Inc.
    - b. Epco Sales, Inc.
    - c. Watts Industries, Inc.; Water Products Div.
    - d. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Epco Sales, Inc.
    - c. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - 1. Manufacturers:
    - a. Calpico, Inc.
    - b. Central Plastics Company.
    - c. Pipeline Seal and Insulator, Inc.
  - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
  - 1. Manufacturers:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
  - 1. Manufacturers:
    - a. Perfection Corp.
    - b. Precision Plumbing Products, Inc.
    - c. Sioux Chief Manufacturing Co., Inc.

## 2.5 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.



- d. Pipeline Seal and Insulator, Inc.
- 2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- 3. Pressure Plates: Carbon steel or Stainless steel. Include two for each sealing element.
- 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.6 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.

## 2.7 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece/Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated.
- D. One-Piece/Split-Plate, Stamped-Steel Type: With concealed or exposed-rivet hinge, set screw or spring clips, and chrome-plated finish.
- E. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

## 2.8 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: Cast-brass type with polished chrome-plated finish.
    - g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - h. Bare Piping in Equipment Rooms: One-piece, cast-brass type or One-piece, stamped steel type.
    - i. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

- M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
    - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
    - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Delete first subparagraph below if not required.
      - 1) Seal space outside of sleeve fittings with grout.
  4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
  2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
  3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.
- R. Verify final equipment locations for roughing-in.
- S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### 3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### 3.5 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1.

### 3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

### 3.8 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout around anchors.
- G. Cure placed grout.

END OF SECTION 220501



## SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

#### 1.3 ACTION SUBMITTALS

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

### PART 2 - PRODUCTS

#### 2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends. PVC sleeves in first paragraph below may be prohibited by fire authorities having jurisdiction.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms. PVC sleeves in paragraph below may be prohibited by fire authorities having jurisdiction.
- G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

#### 2.2 STACK-SLEEVE FITTINGS

- A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
- B. Underdeck Clamp: Clamping ring with setscrews.

## 2.3 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
- B. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Stainless steel.
- D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

## 2.4 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

## 2.5 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

# PART 3 - EXECUTION

## 3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
- C. Sleeves are not required for core-drilled holes.
- D. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
- E. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
- F. Cut sleeves to length for mounting flush with both surfaces.
- G. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
- H. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- I. Install sleeves for pipes passing through interior partitions.



- J. Cut sleeves to length for mounting flush with both surfaces.
- K. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
- L. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- M. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping

### 3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
- B. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
- C. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing.
- D. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.
- E. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
- F. Using grout, seal the space around outside of stack-sleeve fittings.
- G. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping.

### 3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.

- D. Using grout, seal the space around outside of sleeve-seal fittings.

### 3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:

- B. Exterior Concrete Walls above Grade:

1. Piping Smaller Than NPS 6: Cast-iron wall sleeves
2. Piping NPS 6 and Larger: Cast-iron wall sleeves.

- C. Exterior Concrete Walls below Grade:

1. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system
2. Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
3. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
4. Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

- D. Concrete Slabs-on-Grade:

1. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
2. Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
3. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
4. Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

- E. Concrete Slabs above Grade:

1. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
2. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.

- F. Interior Partitions:

1. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
2. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 220517

## SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Escutcheons.
- 2. Floor plates.

#### 1.3 ACTION SUBMITTALS

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

### PART 2 - PRODUCTS

#### 2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.
- E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

#### 2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- C. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
2. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
3. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
4. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
5. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
6. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
7. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
8. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
9. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
10. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
11. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped steel type with concealed hinge.

D. Install floor plates for piping penetrations of equipment-room floors.

E. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

### 3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

## SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Bimetallic-actuated thermometers.
  - 2. Liquid-in-glass thermometers.
  - 3. Thermowells.
  - 4. Dial-type pressure gages.
  - 5. Gage attachments.
  - 6. Test plugs.

- B. Related Sections:

- 1. Section 221116 "Domestic Water Piping" for water meters inside the building.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage, from manufacturer.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 BIMETALLIC-ACTUATED THERMOMETERS

- A. Manufacturers:

- 1. Palmer - Wahl Instruments Inc.
  - 2. Terice, H. O. Co.
  - 3. Weiss Instruments, Inc.
  - 4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

- B. Standard: ASME B40.200.
- C. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch (127-mm) nominal diameter.
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg. F.
- E. Connector Type(s): Union joint, adjustable angle or rigid, with unified-inch screw threads.
- F. Connector Size: 1/2 inch (13 mm) with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch (6.4 or 9.4 mm) in diameter; stainless steel.
- H. Window: Plain glass.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.
- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus or minus 1 percent of scale range.

## 2.2 LIQUID-IN-GLASS THERMOMETERS

- A. Manufacturers:
  - 1. Palmer - Wahl Instruments Inc.
  - 2. Terice, H. O. Co.
  - 3. Weiss Instruments, Inc.
  - 4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
  - 1. Standard: ASME B40.200.
  - 2. Case: Cast aluminum, 6-inch (152-mm) nominal size.
  - 3. Case Form: Back angle or Straight unless otherwise indicated.
  - 4. Tube: Glass with magnifying lens and blue [or red] organic liquid.
  - 5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg. F.
  - 6. Window: Glass or plastic.
  - 7. Stem: Aluminum or brass and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  - 8. Connector: 3/4 inch (19 mm), with ASME B1.1 screw threads.
  - 9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- C. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
  - 1. Standard: ASME B40.200.
  - 2. Case: Cast aluminum, 9-inch (229-mm) nominal size unless otherwise indicated.
  - 3. Case Form: Adjustable angle, Back angle or Straight unless otherwise indicated.
  - 4. Tube: Glass with magnifying lens and blue or red organic liquid.
  - 5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg. F.

6. Window: Glass.
7. Stem: Aluminum and of length to suit installation.
  - a. Design for Thermowell Installation: Bare stem.
8. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

## 2.3 THERMOWELLS

### A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: [CNR] [or] [CUNI] <Insert material>.
4. Material for Use with Steel Piping: [CRES] [CSA] <Insert material>.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

### B. Heat-Transfer Medium: Mixture of graphite and glycerin.

## 2.4 PRESSURE GAGES

### A. Manufacturers:

1. Palmer - Wahl Instruments Inc.
2. Terice, H. O. Co.
3. Weiss Instruments, Inc.
4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

### B. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: [Liquid-filled] [Sealed] [Open-front, pressure relief] [Solid-front, pressure relief] type(s); cast aluminum; 4-1/2-inch (114-mm) nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with [NPS 1/4 (DN 8)] [NPS 1/4 or NPS 1/2 (DN 8 or DN 15)] [NPS 1/2 (DN 15)], ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Stainless steel.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of.

C. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: Liquid-filled, Sealed type; cast aluminum; 4-1/2-inch (114-mm) nominal diameter with [back] [front] flange and holes for panel mounting.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with [NPS 1/4 (DN 8)] [NPS 1/4 or NPS 1/2 (DN 8 or DN 15)] [NPS 1/2 (DN 15)], ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Stainless steel.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of.

2.5 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with [NPS 1/4 (DN 8)] [NPS 1/4 or NPS 1/2 (DN 8 or DN 15)] [NPS 1/2 (DN 15)], ASME B1.20.1 pipe threads and [piston] [porous-metal]-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass or stainless-steel needle, with [NPS 1/4 (DN 8)] [NPS 1/4 or NPS 1/2 (DN 8 or DN 15)] [NPS 1/2 (DN 15)], ASME B1.20.1 pipe threads.

2.6 TEST PLUGS

- A. Description: Test-station fitting made for insertion into piping tee fitting.
- B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- C. Thread Size: [NPS 1/4 (DN 8)] [or] [NPS 1/2 (DN 15)], ASME B1.20.1 pipe thread.
- D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).
- E. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending [a minimum of 2 inches (51 mm) into fluid and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.



- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.
- J. Install test plugs in piping tees.
- K. Install thermometers in the following locations:
  - 1. Inlet and outlet of each water heater.
- L. Install pressure gages in the following locations:
  - 1. Suction and discharge of each domestic water pump.

### 3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

### 3.3 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

### 3.4 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:
  - 1. Liquid-filled or Sealed, bimetallic-actuated type.
  - 2. Industrial]-style, liquid-in-glass type.
  - 3. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.
- B. Thermometer stems shall be of length to match thermowell insertion length.

### 3.5 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C).
- B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F (0 to 150 deg C).
- C. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:

1. Liquid-filled, Sealed, direct-mounted, metal case.
2. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.

D. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:

1. Liquid-filled, Sealed, direct-mounted, metal case.
2. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.

### 3.6 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Water Service Piping: 0 to 200 psi (0 to 1400 kPa).
- B. Scale Range for Domestic Water Piping: 0 to 200 psi (0 to 1400 kPa).

END OF SECTION 220519

## SECTION 220523 - VALVES

### 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 general-duty valves (Lead Free Type):
  - 1. Copper-alloy ball valves.
  - 2. Ferrous-alloy ball valves.
  - 3. Bronze check valves.
  - 4. Ferrous-alloy wafer check valves.
  - 5. Spring-loaded, lift-disc check valves.
  - 6. Bronze gate valves.
  - 7. Bronze globe valves.
- B. Related Sections include the following:
  - 1. Division 22 Section for valve tags and charts.
  - 2. Division 22 piping Sections for specialty valves applicable to those Sections only.
- C. All valves and fittings for portable water system shall be lead-free type in compliant with requirements of NSF/ANSI Standard 61.

#### 1.3 DEFINITIONS

- A. The following are standard abbreviations for valves:
  - 1. CWP: Cold working pressure.
  - 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 3. NBR: Acrylonitrile-butadiene rubber.
  - 4. PTFE: Polytetrafluoroethylene plastic.
  - 5. SWP: Steam working pressure.
  - 6. TFE: Tetrafluoroethylene plastic.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

## 1.5 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.1 for power piping valves and ASME B31.9 for building services piping valves.
  - 1. Exceptions: Domestic hot- and cold-water piping valves unless referenced.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set angle, gate, and globe valves closed to prevent rattling.
  - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
  - 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use hand-wheels or stems as lifting or rigging points.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for 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, the manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 VALVES, GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.
- B. Bronze/Brass Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.

- C. Ferrous Valves: NPS 2-1/2 (DN 65) and larger with flanged ends, unless otherwise indicated.
- D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- F. Valve Actuators:
  - 1. Chain wheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
  - 2. Gear Drive: For quarter-turn valves NPS 8 (DN 200) and larger.
  - 3. Hand wheel: For valves other than quarter-turn types.
  - 4. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.
  - 5. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.
- G. Extended Valve Stems: On insulated valves.
- H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- I. Valve Grooved Ends: AWWA C606.
  - 1. Solder Joint: With sockets according to ASME B16.18.
    - a. Caution: Use solder with melting point below 840 deg F (454 deg C) for angle, check, gate, and globe valves; below 421 deg F (216 deg C) for ball valves.
  - 2. Threaded: With threads according to ASME B1.20.1.
- J. Valve Bypass and Drain Connections: MSS SP-45.

## 2.3 COPPER-ALLOY BALL VALVES

- A. Available Manufacturers:
- B. Manufacturers:
  - 1. One-Piece, Copper-Alloy Ball Valves:
    - a. American Valve, Inc.
    - b. Conbraco Industries, Inc.; Apollo Div.
    - c. Grinnell Corporation.
    - d. Kitz Corporation of America.
    - e. Legend Valve & Fitting, Inc.
    - f. NIBCO INC.
    - g. Watts Industries, Inc.; Water Products Div.
- C. Copper-Alloy Ball Valves, General: MSS SP-110, full port type.
- D. One-Piece, Copper-Alloy Ball Valves: Brass or bronze body with chrome-plated bronze ball, PTFE or TFE seats, full port type.

## 2.4 FERROUS-ALLOY BALL VALVES

- A. Available Manufacturers:
- B. Manufacturers:
  - 1. American Valve, Inc.
  - 2. Conbraco Industries, Inc.; Apollo Div.
  - 3. Cooper Cameron Corp.; Cooper Cameron Valves Div.
  - 4. Flow-Tek, Inc.
  - 5. Hammond Valve.
  - 6. Kitz Corporation of America.
  - 7. KTM Products, Inc.
  - 8. Milwaukee Valve Company.
  - 9. NIBCO INC.
  - 10. Richards Industries; Marwin Ball Valves.
- C. Ferrous-Alloy Ball Valves, General: MSS SP-72, with flanged ends, full port.
- D. Ferrous-Alloy Ball Valves: Class 150, full port.

## 2.5 BRONZE CHECK VALVES

- A. Available Manufacturers:
- B. Manufacturers:
  - 1. Type 1, Bronze, Horizontal Lift Check Valves with Metal Disc:
    - a. Cincinnati Valve Co.
    - b. Red-White Valve Corp.
    - c. Walworth Co.
  - 2. Type 1, Bronze, Vertical Lift Check Valves with Metal Disc:
    - a. Cincinnati Valve Co.
    - b. Red-White Valve Corp.
    - c. NIBCO INC.
  - 3. Type 3, Bronze, Swing Check Valves with Metal Disc:
    - a. American Valve, Inc.
    - b. Cincinnati Valve Co.
    - c. Grinnell Corporation.
    - d. Hammond Valve.
    - e. Kitz Corporation of America.
    - f. Legend Valve & Fitting, Inc.
    - g. Milwaukee Valve Company.
    - h. NIBCO INC.
    - i. Powell, Wm. Co.
    - j. Red-White Valve Corp.
    - k. Walworth Co.
    - l. Watts Industries, Inc.; Water Products Div.
- C. Bronze Check Valves, General: MSS SP-80.
- D. Type 1, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with bronze disc and seat.

- E. Type 1, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with bronze disc and seat.
- F. Type 3, Class 150, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.

## 2.6 FERROUS-ALLOY WAFER CHECK VALVES

- A. Available Manufacturers:
- B. Manufacturers:
  - 1. Dual-Plate, Ferrous-Alloy, Wafer-Lug Check Valves:
    - a. Gulf Valve Co.
    - b. Valve and Primer Corp.
    - c. NIBCO INC.
  - 2. Dual-Plate, Ferrous-Alloy, Double-Flanged-Type Check Valves:
    - a. Gulf Valve Co.
    - b. Techno Corp.
    - c. NIBCO INC.
- C. Ferrous-Alloy Wafer Check Valves, General: API 594, spring loaded.
- D. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.

## 2.7 SPRING-LOADED, LIFT-DISC CHECK VALVES

- A. Available Manufacturers:
- B. Manufacturers:
  - 1. Type I, Wafer Lift-Disc Check Valves:
    - a. Mueller Steam Specialty.
  - 2. Type II, Compact-Wafer, Lift-Disc Check Valves:
    - a. Durabla Fluid Technology, Inc.
    - b. Flomatic Valves.
    - c. Grinnell Corporation.
    - d. Hammond Valve.
    - e. Metraflex Co.
    - f. Milwaukee Valve Company.
    - g. Mueller Steam Specialty.
    - h. NIBCO INC.
  - 3. Type III, Globe Lift-Disc Check Valves:
    - a. Durabla Fluid Technology, Inc.
    - b. GA Industries, Inc.
    - c. Grinnell Corporation.
    - d. Hammond Valve.
    - e. Metraflex Co.
    - f. Milwaukee Valve Company.
    - g. NIBCO INC.
  - 4. Type IV, Threaded Lift-Disc Check Valves:
    - a. Check-All Valve Mfg. Co.
    - b. Durabla Fluid Technology, Inc.
    - c. Grinnell Corporation.

- d. Legend Valve & Fitting, Inc.
  - e. Metraflex Co.
  - f. Milwaukee Valve Company.
  - g. Mueller Steam Specialty.
  - h. NIBCO INC.
  - i. Watts Industries, Inc.; Water Products Div.
- C. Lift-Disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.
  - D. Type I, Class 125, Wafer Lift-Disc Check Valves: Wafer style with cast-iron shell with diameter matching companion flanges.
  - E. Type II, Class 125, Compact-Wafer, Lift-Disc Check Valves: Compact-wafer style with cast-iron shell with diameter made to fit within bolt circle.
  - F. Type III, Class 125, Globe Lift-Disc Check Valves: Globe style with cast-iron shell and flanged ends.
  - G. Type IV, Class 125, Threaded Lift-Disc Check Valves: Threaded style with bronze shell and threaded ends.

## 2.8 BRONZE GATE VALVES

### A. Available Manufacturers:

### B. Manufacturers:

- 1. Type 1, Bronze, Non-Rising-Stem Gate Valves:
  - a. American Valve, Inc.
  - b. Cincinnati Valve Co.
  - c. Grinnell Corporation.
  - d. Hammond Valve.
  - e. Kitz Corporation of America.
  - f. Legend Valve & Fitting, Inc.
  - g. Milwaukee Valve Company.
  - h. NIBCO INC.
  - i. Powell, Wm. Co.
  - j. Red-White Valve Corp.
  - k. Walworth Co.
  - l. Watts Industries, Inc.; Water Products Div.
- 2. Type 2, Bronze, Rising-Stem, Solid-Wedge Gate Valves:
  - a. American Valve, Inc.
  - b. Cincinnati Valve Co.
  - c. Grinnell Corporation.
  - d. Hammond Valve.
  - e. Kitz Corporation of America.
  - f. Milwaukee Valve Company.
  - g. NIBCO INC.
  - h. Powell, Wm. Co.
  - i. Red-White Valve Corp.
  - j. Walworth Co.

### C. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy hand wheel.



- D. Type 1, Class 150, Bronze Gate Valves: Bronze body with non-rising stem and bronze solid wedge and union-ring bonnet.
- E. Type 2, Class 150, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge and union-ring bonnet.

## 2.9 BRONZE GLOBE VALVES

### A. Available Manufacturers:

### B. Manufacturers:

- 1. Type 1, Bronze Globe Valves with Metal Disc:
  - a. Cincinnati Valve Co.
  - b. Grinnell Corporation.
  - c. Hammond Valve.
  - d. Kitz Corporation of America.
  - e. Legend Valve & Fitting, Inc.
  - f. Milwaukee Valve Company.
  - g. NIBCO INC.
  - h. Powell, Wm. Co.
  - i. Red-White Valve Corp.
  - j. Walworth Co.
- 2. Type 2, Bronze Globe Valves with Nonmetallic Disc:
  - a. Cincinnati Valve Co.
  - b. Grinnell Corporation.
  - c. Hammond Valve.
  - d. Kitz Corporation of America.
  - e. McWane, Inc.; Kennedy Valve Div.
  - f. Milwaukee Valve Company.
  - g. NIBCO INC.
  - h. Powell, Wm. Co.
  - i. Red-White Valve Corp.
  - j. Walworth Co.
- 3. Type 3, Bronze Globe Valves with Renewable Seat and Metal Disc:
  - a. Cincinnati Valve Co.
  - b. Grinnell Corporation.
  - c. Hammond Valve.
  - d. Milwaukee Valve Company.
  - e. NIBCO INC.
  - f. Walworth Co.

- C. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy hand wheel.
- D. Type 1, Class 150, Bronze Globe Valves: Bronze body with bronze disc and union-ring bonnet.
- E. Type 3, Class 150, Bronze Globe Valves: Bronze body with bronze disc and renewable seat. Include union-ring bonnet.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE APPLICATIONS

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball or gate valves.
  - 2. Throttling Service: Ball or globe valves.
  - 3. Pump Discharge: Spring-loaded, lift-disc check valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Heating Water Piping: Use the following types of valves:
  - 1. Ball Valves, NPS 2 (DN 50) and Smaller: One or Two-piece, CWP rating, copper alloy.
  - 2. Ball Valves, NPS 2-1/2 (DN 65) and Larger: Class 150, ferrous alloy.
  - 3. Lift Check Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, horizontal / vertical, bronze.
  - 4. Swing Check Valves, NPS 2 (DN 50) and Smaller: Type 4, Class 150, bronze.
  - 5. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, gray iron.
  - 6. Wafer Check Valves, NPS 2-1/2 (DN 65) and Larger: Single / Dual-plate, wafer-lug/ double-flanged, Class 150, ferrous alloy.
  - 7. Spring-Loaded, Lift-Disc Check Valves, NPS 2 (DN 50) and Smaller: Type IV, Class 150.
  - 8. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 (DN 65) and Larger: Class 125, cast iron.
  - 9. Gate Valves, NPS 2 (DN 50) and Smaller: Type 2 / 3, Class 150, bronze.
  - 10. Globe Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.

### 3.3 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.
- F. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
  - 2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
  - 3. Lift Check Valves: With stem upright and plumb.

### 3.4 JOINT CONSTRUCTION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

### 3.5 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 220523



## SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND 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. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.

- B. Related Sections:

1. Section 233113 "Metal Ducts" for duct hangers and supports.

#### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  3. Design seismic-restraint hangers and supports for piping and equipment.
- C. Provide hangers and supports with insulation shields in order to keep insulation fully in-tact.

## 1.5 SUBMITTALS

### A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Fiberglass pipe hangers.
3. Thermal-hanger shield inserts.
4. Powder-actuated fastener systems.
5. Pipe positioning systems.

### B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Fiberglass strut systems. Include Product Data for components.
4. Pipe stands. Include Product Data for components.
5. Equipment supports.
6. Welding certificates.

## 1.6 QUALITY ASSURANCE

### A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code Steel."

### B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

## PART 2 - PRODUCTS

### 2.1 METAL PIPE HANGERS AND SUPPORTS

#### A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

#### B. Copper Pipe Hangers:

1. Manufacturers' catalogs indicate that copper pipe hangers are small, typically NPS 4 (DN 100) or smaller, and types available are limited.
2. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

## 2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

## 2.3 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688 kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or [ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

## 2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] [stainless-] steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 2.5 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
  - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
  - 2. Base: Stainless steel.
  - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
  - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

5. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

## 2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
  1. Properties: Non-staining, noncorrosive, and nongaseous.
  2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
- C. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
- D. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- E. Metal framing system in first paragraph below requires calculating and detailing at each use.
- F. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- G. Fiberglass strut system in first paragraph below requires calculating and detailing at each use.
- H. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping
- I. Fastener System Installation:
  1. Verify suitability of fasteners in two subparagraphs below for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick.
  2. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.



3. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- J. Pipe stand in first paragraph below requires calculating and detailing at each use.
- K. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.
  3. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- L. Equipment support in first paragraph below requires calculating and detailing at each use.
- M. Equipment Support Installation:
1. Fabricate from welded-structural-steel shapes.
  2. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
  3. Install lateral bracing with pipe hangers and supports to prevent swaying.
  4. Install building attachments within concrete slabs or attach to structural steel.
  5. Install additional attachments at concentrated loads, including valves, flanges, and strainers, [NPS 2-1/2 (DN 65)] <Insert size> and larger and at changes in direction of piping.
  6. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts
- N. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- P. Insulated Piping:
1. Attach clamps and spacers to piping.
  2. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
  3. Piping Operating Below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
  4. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  5. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated.
  6. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
  7. High-compressive-strength inserts may permit use of shorter shields or shields with less arc span. Revise first subparagraph below to suit Project.
  8. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
- Q. Shield Dimensions for Pipe: Not less than the following:

1. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
  2. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
  3. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
  4. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
  5. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
- R. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
- S. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

### 3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
- B. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- C. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099123 "Interior Painting".
- D. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
  - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
  - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
  - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
  - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
  - 8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
  - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
  - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
  - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
  - 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
  - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  - 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  - 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  - 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  - 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
  - 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.

19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb (340 kg).
    - b. Medium (MSS Type 32): 1500 lb (680 kg).
    - c. Heavy (MSS Type 33): 3000 lb (1360 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 220529



## SECTION 220548 - VIBRATION CONTROLS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Restrained spring isolators.
  - 2. Housed spring mounts.
  - 3. Spring hangers.
  - 4. Spring hangers with vertical-limit stops.
  - 5. Thrust limits.
  - 6. Pipe riser resilient supports.
- B. Definitions:
  - 1.  $A_v$ : Effective peak velocity related acceleration coefficient.

#### 1.2 SUBMITTALS

- A. Product Data: Include load deflection curves for each vibration isolation device indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:
  - 1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
  - 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
  - 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
  - 4. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
  - 5. Details for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y, and z planes.

#### 1.3 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code-Steel."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for 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, the manufacturers specified.
  2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 VIBRATION ISOLATORS

- A. Available Manufacturers:
1. Ace Mounting Co., Inc.
  2. Amber/Booth Company, Inc.
  3. B-Line Systems, Inc.
  4. California Dynamics Corp.
  5. Isolation Technology, Inc.
  6. Kinetics Noise Control, Inc.
  7. Mason Industries, Inc.
  8. Vibration Eliminator Co., Inc.
  9. Vibration Isolation Co., Inc.
  10. Vibration Mountings & Controls/Korfund.
- B. Restrained Elastomeric Mounts: All-directional elastomeric mountings with seismic restraint.
1. Materials: Cast-ductile-iron housing containing two separate and opposing, molded, bridge-bearing neoprene elements that prevent central threaded sleeve and attachment bolt from contacting the casting during normal operation.
  2. Neoprene: Shock-absorbing materials compounded as defined by AASHTO.
- C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  3. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
  4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 100 psig.
  6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.



1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
  2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- E. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
  2. Base: Factory drilled for bolting to structure.
  3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel before contacting a resilient collar.
- F. Elastomeric Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.
- G. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
  2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
- H. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
  2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
  7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
- I. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression and with a load stop. Include rod and angle-iron brackets for attaching to equipment.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
  2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
  7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.
- J. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- thick, 60-durometer neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.
- K. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes separated by a minimum of 1/2-inch- thick, 60-durometer neoprene. Factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction. Shear pin shall be removable and re-insertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.
- B. Install restraining cables at each trapeze and individual pipe hanger. At trapeze anchor locations, shackle piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.
- C. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.
- D. Install resilient bolt isolation washers on equipment anchor bolts.

### 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  1. Inspect isolator seismic-restraint clearance.
  2. Test isolator deflection.
  3. Inspect minimum snubber clearances.
- B. Provide certification report to A/E.

### 3.3 ADJUSTING

- A. Adjust isolators after piping systems have been filled and equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.
- D. Adjust air spring leveling mechanism.
- E. Adjust active height of spring isolators.
- F. Adjust snubbers according to manufacturer's written recommendations.
- G. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.
- H. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

END OF SECTION 220548



## SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:
  - 1. Equipment nameplates
  - 2. Equipment markers
  - 3. Equipment signs
  - 4. Access panel and door markers
  - 5. Valve tags
  - 6. Pipe Markers

#### 1.2 SUBMITTALS

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

#### 1.3 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
  - 1. Data:
    - a. Manufacturer, product name, model number, and serial number.
    - b. Capacity, operating and power characteristics, and essential data.
    - c. Labels of tested compliances.
  - 2. Location: Accessible and visible.
  - 3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
  - 1. Terminology: Match schedules as closely as possible.
  - 2. Data:
    - a. Name and plan number
    - b. Equipment service
    - c. Design capacity
    - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed

3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
  1. Data: Instructions for operation of equipment and for safety procedures.
  2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
  3. Thickness: 1/8 inch, unless otherwise indicated.
  4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
- D. Access Panel and Door Markers: 1/16-inch thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
  1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

## 2.2 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
  1. Colors: Comply with ASME A13.1, unless otherwise indicated.
  2. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
  3. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
  4. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Pre-tensioned Pipe Markers: Pre-coiled semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- C. Shaped Pipe Markers: Preformed semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.
- D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.
  1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
  2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

## 2.3 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme. Provide 5/32-inch hole for fastener.
  - 1. Material: 0.032 inch-thick brass/aluminum
  - 2. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook

## PART 3 - EXECUTION

### 3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 22 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

### 3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
  - 1. Fuel-burning units, including boilers, furnaces, heaters
  - 2. Pumps and similar motor-driven units.
  - 3. Fans.
- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
  - 1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
  - 3. Locate markers where accessible and visible.
    - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    - b. Meters, gages, thermometers, and similar units.
    - c. Fuel-burning units, including boilers, furnaces, heaters.
    - d. Pumps and similar motor-driven units.
    - e. Fans.
- C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
  - 1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
- D. Install access panel markers with screws on equipment access panels.

### 3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pre-tensioned pipe markers. Use size to ensure a tight fit.
  2. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 3/4 inch wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
  3. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.
  4. Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.
- B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed locations as follows:
1. Near each valve and control device.
  2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations through walls, floors, ceilings, and non-accessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  7. On piping above removable acoustical ceilings, omit intermediately spaced markers.

### 3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:
1. Valve-Tag Size and Shape:
    - a. Hot Water: 1-1/2 inches, round/square
    - b. Gas: 1-1/2 inches, round/square
    - c. Steam: 1-1/2 inches, round/square



3.5 ADJUSTING AND CLEANING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.
- B. Clean faces of mechanical identification devices.

END OF SECTION 220553



## SECTION 220719 - PLUMBING PIPING 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

- A. This Section includes mechanical insulation for duct, equipment, and pipe, including the following:
  - 1. Insulation Materials:
    - a. Cellular glass.
    - b. Mineral fiber.
    - c. Polystyrene.
  - 2. Fire-rated insulation systems.
  - 3. Adhesives.
  - 4. Mastics.
  - 5. Lagging adhesives.
  - 6. Sealants.
  - 7. Field-applied jackets.
  - 8. Tapes.
  - 9. Securements.
  - 10. Corner angles.

#### 1.3 DEFINITIONS

- A. ASJ: All-service jacket.
- B. FSK: Foil, scrim, kraft paper.
- C. FSP: Foil, scrim, polyethylene.
- D. PVDC: Polyvinylidene chloride.
- E. SSL: Self-sealing lap.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings: Show details for the following:
  - 1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Attachment and covering of heat tracing inside insulation.

3. Insulation application at pipe expansion joints for each type of insulation.
  4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  5. Removable insulation at piping specialties, equipment connections, and access panels.
  6. Application of field-applied jackets.
  7. Application at linkages of control devices.
  8. Field application for each equipment type.
- C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2 (DN 50).
  2. Sheet Form Insulation Materials: 12 inches square.
  3. Jacket Materials for Pipe: 12 inches long by NPS 2 (DN 50).
  4. Sheet Jacket Materials: 12 inches square.
  5. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.
- D. Installer Certificates: Signed by Contractor certifying that installers comply with requirements.
- E. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- F. Field quality-control inspection reports.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## 1.7 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

## 1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## 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.
  - 3. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 INSULATION MATERIALS

- A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
  - 1. Products:
    - a. Cell-U-Foam Corporation; Ultra-CUF.
    - b. Pittsburgh Corning Corporation; Foamglas Super K.
  - 2. Block Insulation: ASTM C 552, Type I.
  - 3. Special-Shaped Insulation: ASTM C 552, Type III.
  - 4. Board Insulation: ASTM C 552, Type IV.
  - 5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
  - 6. Preformed Pipe Insulation with Factory-Applied [ASJ] [ASJ-SSL]: Comply with ASTM C 552, Type II, Class 2.
  - 7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Products:
    - a. Fibrex Insulations Inc.; Coreplus 1200.
    - b. Johns Manville; Micro-Lok.
    - c. Knauf Insulation; 1000° Pipe Insulation.
    - d. Manson Insulation Inc.; Alley-K.
    - e. Owens Corning; Fiberglas Pipe Insulation.
  - 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
- H. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.
  - 1. Products:
    - a. Knauf Insulation; Permawick Pipe Insulation.
    - b. Owens Corning; VaporWick Pipe Insulation.
- I. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied [ASJ] [FSK jacket] complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
  - 1. Products:
    - a. CertainTeed Corp.; CrimpWrap.
    - b. Johns Manville; MicroFlex.
    - c. Knauf Insulation; Pipe and Tank Insulation.
    - d. Manson Insulation Inc.; AK Flex.
    - e. Owens Corning; Fiberglas Pipe and Tank Insulation.

## 2.3 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. UL tested and certified to provide a 2-hour fire rating.
  - 1. Products:
    - a. Johns Manville; Super Firetemp M.
- B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is UL tested and certified to provide a 2-hour fire rating.
  - 1. Products:
    - a. CertainTeed Corp.; FlameChek.
    - b. Johns Manville; Firetemp Wrap.
    - c. Nelson Firestop Products; Nelson FSB Flameshield Blanket.
    - d. Thermal Ceramics; FireMaster Duct Wrap.
    - e. 3M; Fire Barrier Wrap Products.
    - f. Unifrax Corporation; FyreWrap.
    - g. Vesuvius; PYROSCAT FP FASTR Duct Wrap.

## 2.4 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.
  - 1. Products:
    - a. Childers Products, Division of ITW; CP-97.
    - b. Foster Products Corporation, H. B. Fuller Company; 81-27/81-93.
    - c. Marathon Industries, Inc.; 290.
    - d. Mon-Eco Industries, Inc.; 22-30.
    - e. Vimasco Corporation; 760.
- C. Cellular-Glass, Phenolic-Foam, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
  - 1. Products:
    - a. Childers Products, Division of ITW; CP-96.
    - b. Foster Products Corporation, H. B. Fuller Company; 81-33.
- D. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. Products:
    - a. Aeroflex USA Inc.; Aero seal.
    - b. Armacell LCC; 520 Adhesive.
    - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
    - d. RBX Corporation; Rubatex Contact Adhesive.
- E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products:
  - a. Childers Products, Division of ITW; CP-82.
  - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
  - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
  - d. Marathon Industries, Inc.; 225.
  - e. Mon-Eco Industries, Inc.; 22-25.
  
- F. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of minus 20 to plus 140 deg F.
  1. Products:
    - a. Childers Products, Division of ITW; CP-96.
    - b. Foster Products Corporation, H. B. Fuller Company; 97-13.
  
- G. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  1. Products:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.
  
- H. PVC Jacket Adhesive: Compatible with PVC jacket.
  1. Products:
    - a. Dow Chemical Company (The); 739, Dow Silicone.
    - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    - c. P.I.C. Plastics, Inc.; Welding Adhesive.
    - d. Red Devil, Inc.; Celulon Ultra Clear.
    - e. Speedline Corporation; Speedline Vinyl Adhesive.

## 2.5 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
  
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
  1. Products:
    - a. Childers Products, Division of ITW; CP-35.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
    - c. ITW TACC, Division of Illinois Tool Works; CB-50.
    - d. Marathon Industries, Inc.; 590.
    - e. Mon-Eco Industries, Inc.; 55-40.
    - f. Vimasco Corporation; 749.
  2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
  5. Color: White.



C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products:
  - a. Childers Products, Division of ITW; CP-30.
  - b. Foster Products Corporation, H. B. Fuller Company; 30-35.
  - c. ITW TACC, Division of Illinois Tool Works; CB-25.
  - d. Marathon Industries, Inc.; 501.
  - e. Mon-Eco Industries, Inc.; 55-10.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products:
  - a. Childers Products, Division of ITW; Encacel.
  - b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
  - c. Marathon Industries, Inc.; 570.
  - d. Mon-Eco Industries, Inc.; 55-70.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products:
  - a. Childers Products, Division of ITW; CP-10.
  - b. Foster Products Corporation, H. B. Fuller Company; 35-00.
  - c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
  - d. Marathon Industries, Inc.; 550.
  - e. Mon-Eco Industries, Inc.; 55-50.
  - f. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

## 2.6 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products:
  - a. Childers Products, Division of ITW; CP-52.
  - b. Foster Products Corporation, H. B. Fuller Company; 81-42.
  - c. Marathon Industries, Inc.; 130.
  - d. Mon-Eco Industries, Inc.; 11-30.
  - e. Vimasco Corporation; 136.
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F.
4. Color: White.

## 2.7 SEALANTS

### A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic-Foam, and Polyisocyanurate Products:
  - a. Childers Products, Division of ITW; CP-76.
  - b. Foster Products Corporation, H. B. Fuller Company; 30-45.
  - c. Marathon Industries, Inc.; 405.
  - d. Mon-Eco Industries, Inc.; 44-05.
  - e. Pittsburgh Corning Corporation; Pittseal 444.
  - f. Vimasco Corporation; 750.
2. Joint Sealants for Polystyrene Products:
  - a. Childers Products, Division of ITW; CP-70.
  - b. Foster Products Corporation, H. B. Fuller Company; 30-45/30-46.
  - c. Marathon Industries, Inc.; 405.
  - d. Mon-Eco Industries, Inc.; 44-05.
  - e. Vimasco Corporation; 750.
3. Materials shall be compatible with insulation materials, jackets, and substrates.
4. Permanently flexible, elastomeric sealant.
5. Service Temperature Range: Minus 100 to plus 300 deg F.
6. Color: White or gray.

### B. FSK and Metal Jacket Flashing Sealants:

1. Products:
  - a. Childers Products, Division of ITW; CP-76-8.
  - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
  - c. Marathon Industries, Inc.; 405.
  - d. Mon-Eco Industries, Inc.; 44-05.
  - e. Vimasco Corporation; 750.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

### C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products:
  - a. Childers Products, Division of ITW; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

## 2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto PVC Corporation; LoSmoke.
    - d. Speedline Corporation; SmokeSafe.
  2. Adhesive: As recommended by jacket material manufacturer.
  3. Color: White.
  4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
  5. Factory-fabricated tank heads and tank side panels.
- D. Metal Jacket:
1. Products:
    - a. Childers Products, Division of ITW; Metal Jacketing Systems.
    - b. PABCO Metals Corporation; Surefit.
    - c. RPR Products, Inc.; Insul-Mate.
- E. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

## 2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.
1. Products:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
    - b. Compac Corp.; 104 and 105.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  2. Width: 3 inches
  3. Thickness: 11.5 mils
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.
1. Products:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - b. Compac Corp.; 110 and 111.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
    - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
  2. Width: 3 inches.
  3. Thickness: 6.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Products:
  - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
  - b. Compac Corp.; 130.
  - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
  - d. Venture Tape; 1506 CW NS.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.

1. Products:
  - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
  - b. Compac Corp.; 120.
  - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
  - d. Venture Tape; 3520 CW.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

## 2.10 SECUREMENTS

- A. Bands:

1. Products:
  - a. Childers Products; Bands.
  - b. PABCO Metals Corporation; Bands.
  - c. RPR Products, Inc.; Bands.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

- B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch diameter shank, length to suit depth of insulation indicated.
  - a. Products:
    - 1) AGM Industries, Inc.; CWP-1.
    - 2) GEMCO; CD.
    - 3) Midwest Fasteners, Inc.; CD.
    - 4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
    - a. Products:
      - 1) AGM Industries, Inc.; CWP-1.
      - 2) GEMCO; Cupped Head Weld Pin.
      - 3) Midwest Fasteners, Inc.; Cupped Head.
      - 4) Nelson Stud Welding; CHP.
  3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
    - a. Products:
      - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
      - 2) GEMCO; Perforated Base.
      - 3) Midwest Fasteners, Inc.; Spindle.
    - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
    - c. Spindle: Aluminum, fully annealed, 0.106-inch diameter shank, length to suit depth of insulation indicated.
    - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
  4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
    - a. Products:
      - 1) AGM Industries, Inc.; RC-150.
      - 2) GEMCO; R-150.
      - 3) Midwest Fasteners, Inc.; WA-150.
      - 4) Nelson Stud Welding; Speed Clips.
    - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, galvanized steel.
1. Manufacturers:
    - a. ACS Industries, Inc.
    - b. C & F Wire.
    - c. Childers Products.
    - d. PABCO Metals Corporation.
    - e. RPR Products, Inc.

## 2.11 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or 316.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
  - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Stainless Steel: Coat 300 series stainless steel with epoxy primer 5 mils thick and epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.

- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches or 4 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.

4. Manholes.
5. Handholes.
6. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
- F. Insulation Installation at Floor Penetrations:
  1. Pipe: Install insulation continuously through floor penetrations.

### 3.5 EQUIPMENT INSULATION INSTALLATION

- A. Secure insulation with adhesive and anchor pins and speed washers.
  1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.



2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
  - a. Do not weld anchor pins to ASME-labeled pressure vessels.
  - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
  - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
  - d. Do not over compress insulation during installation.
  - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
  - f. Impale insulation over anchor pins and attach speed washers.
  - g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

### 3.6 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt

- each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.7 CELLULAR-GLASS INSULATION INSTALLATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

#### C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

#### D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

### 3.8 MINERAL-FIBER INSULATION INSTALLATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.10 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous UL-listed fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies.

### 3.11 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below.
  - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.12 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Fire-suppression piping.
  - 2. Drainage piping located in crawl spaces.
  - 3. Below-grade piping.
  - 4. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.13 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
  - 1. NPS 3 (DN 75) and Smaller: Insulation shall be any of the following:
    - a. Cellular Glass: 1-1/2 inch thick.
    - b. Mineral-Fiber Pipe Insulation, Type I: 1-1/2 inch thick.
  - 2. NPS 4 (DN 32) and Larger: Insulation shall be any of the following:
    - a. Cellular Glass: 2 inches thick.
    - b. Mineral-Fiber Pipe Insulation, Type I: 2 inches thick.
- B. Domestic Hot and Recirculated Hot Water:
  - 1. NPS 3 (DN 75) and Smaller: Insulation shall be any of the following:
    - a. Cellular Glass: 1-1/2 inches thick.
    - b. Mineral-Fiber Pipe Insulation, Type I: 1-1/2 inch thick.
  - 2. NPS 4 (DN 100) and Larger: Insulation shall be any of the following:
    - a. Cellular Glass: 2 inches thick.
    - b. Mineral-Fiber Pipe Insulation, Type I: 2 inch thick.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
  - 1. Aluminum, Smooth: 0.016 inch thick.

END OF SECTION 220719

## SECTION 221116 - DOMESTIC WATER PIPING

### 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 domestic water piping inside the building and 5 feet to outside of the building.
- B. Related Sections include the following:
  - 1. Division 22 Section "Domestic Water Piping Specialties" for water distribution piping specialties.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with 80 psig, unless otherwise indicated.

#### 1.4 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Water Samples: Specified in Part 3 "Cleaning" Article.
- C. Field quality-control test reports.

#### 1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

### 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 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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 PIPING MATERIALS

- A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

## 2.3 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B), water tube, annealed temper.
  1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
  3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- B. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.
  1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
  3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

## 2.4 CPVC PIPING

- A. CPVC Pipe: ASTM F 441/F 441M, Schedule 40.
  1. CPVC Socket Fittings: ASTM F 438 for Schedule 40.
- B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.
- C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

## 2.5 PEX TUBE AND FITTINGS

- A. PEX Distribution System: ASTM F 877, SDR 9 tubing.



- B. Fittings for PEX Tube: ASTM F 1807, metal-insert type with copper or stainless-steel crimp rings and matching PEX tube dimensions.
- C. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 877; with plastic or corrosion-resistant-metal valve for each outlet.

## 2.6 VALVES

- A. General-duty ball valves are specified in Division 22 Section "Valves."
- B. Backflow preventers, strainers, and drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

## PART 3 - EXECUTION

### 3.1 PIPE AND FITTING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Fitting Option: brazed joints may be used on aboveground copper tubing.
- D. Under-Building-Slab, Domestic Water Piping on House Side of Water Meter, NPS 4 (DN 100) and Smaller: Soft copper tube, Type K with no fittings.
- E. Aboveground Domestic Water Piping: Use the following piping materials for each size range:
  - 1. NPS 1 (DN 25) and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
  - 2. NPS 2 (DN 50): Hard copper tube, Type L; copper pressure fittings; and soldered joints.

### 3.2 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use ball valves for piping NPS 3 (DN 75) and smaller.
  - 2. Drain Duty: Hose-end drain valves.
- B. Install drain valves at low points in horizontal piping, and where required to drain water piping.
  - 1. Install hose-end drain valves at low points in water mains, risers, and branches.

### 3.3 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."

- B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- E. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

### 3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Mechanical Vibration and Seismic Controls."
- B. Pipe hanger and support devices are specified in Division 22 Section "Hangers and Supports." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet: MSS Type 49, spring cushion rolls, if indicated.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.
- F. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 (DN 20) and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches with 3/8-inch rod.
  - 4. NPS 2-1/2 (DN 65): 108 inches with 1/2-inch rod.
  - 5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet with 1/2-inch rod.
  - 6. NPS 6 (DN 150): 10 feet with 5/8-inch rod.

- G. Install supports for vertical copper tubing every 10 feet.

### 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

### 3.7 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
  - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
  - 2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
    - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
  - 3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
  - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping as follows:
  - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
  - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
  - 6. Prepare reports for tests and required corrective action.

### 3.8 ADJUSTING

- A. Perform the following adjustments before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.

2. Open shutoff valves to fully open position.
3. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
4. Remove and clean strainer screens. Close drain valves and replace drain plugs.
5. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.9 CLEANING

- A. Clean and disinfect potable and non-potable domestic water piping as follows:
  1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
  2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116

## SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Balancing valves.
  - 2. Strainers.
  - 3. Drain valves.
  - 4. Air vents.
  - 5. Hose bibbs.
  - 6. Wall hydrants.
  - 7. Water hammer arresters.
  - 8. Trap-seal primer valves.
  - 9. Trap-seal primer systems.

- B. Related Sections include the following:

- 1. Division 22 Section "Meters and Gages" for thermometers, pressure gages, and flow meters in domestic water piping.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 80 psig, unless otherwise indicated.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. 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.
- B. NSF Compliance:
  - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
  - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

## PART 2 - PRODUCTS

### 2.1 BALANCING VALVES

#### A. Copper-Alloy Calibrated Balancing Valves:

1. 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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on drawings or a comparable product by one of the following:
  - a. To require a specific valve type (ball, globe, or Y-pattern globe) or a specific material (brass or bronze), verify its availability with manufacturer.
    1. Armstrong International, Inc.
    2. ITT Industries; Bell & Gossett Div.
    3. NIBCO INC.
    4. Taco, Inc.
    5. Watts Industries, Inc.; Water Products Div.
    6. Or approved equal.
3. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
4. Body: Brass or bronze,
5. Size: Same as connected piping, but not larger than NPS 2 (DN 50).
6. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

#### B. Memory-Stop Balancing Valves:

1. 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:
  - a. Conbraco Industries, Inc.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Hammond Valve.
  - d. Milwaukee Valve Company.
  - e. NIBCO INC.
  - f. Red-White Valve Corp.
  - g. Or approved equal.
2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 (DN 50) or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

### 2.2 STRAINERS FOR DOMESTIC WATER PIPING

#### A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and] for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.

5. Perforation Size:
  - a. Strainers NPS 2 (DN 50) and Smaller: 0.020 inch.
  - b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.045 inch.
6. Drain: Pipe plug or Factory-installed, hose-end drain valve.

## 2.3 DRAIN VALVES

### A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

### B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4 (DN 20).
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 (DN 20) threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

### C. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 (DN 6) side outlet with cap.

## 2.4 AIR VENTS

### A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 (DN 10) or NPS 1/2 (DN 15)] minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

### B. Welded-Construction Automatic Air Vents <Insert drawing designation if any>:

1. Body: Stainless steel.
2. Pressure Rating: 150-psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 (DN 10) minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

## 2.5 HOSE BIBBS

### A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral, non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

## 2.6 WALL HYDRANTS

- A. Non-Freeze Wall Hydrants: Refer to schedule on Drawing P6.03.
- B. 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:
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Josam Company.
  2. MIFAB, Inc.
  3. Prier Products, Inc.
  4. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  5. Tyler Pipe; Wade Div.
  6. Watts Drainage Products Inc.
  7. Woodford Manufacturing Company.
  8. Zurn Plumbing Products Group; Light Commercial Operation.
  9. Zurn Plumbing Products Group; Specification Drainage Operation.
  10. Or approved equal.
- D. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
- E. Pressure Rating: 125 psig.
- F. Operation: Loose key.
- G. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
- H. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).
- I. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
- J. Box: Deep, flush mounting with cover.
- K. Box and Cover Finish: Chrome plated.



- L. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
- M. Nozzle and Wall-Plate Finish: Rough bronze.
- N. Operating Keys(s): Two (2) with each wall hydrant.

## 2.7 WATER HAMMER ARRESTERS

- A. Water Hammer Arresters: Refer to schedule on Drawing P6.03.
- B. 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:
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AMTROL, Inc.
  - 2. Josam Company.
  - 3. MIFAB, Inc.
  - 4. PPP Inc.
  - 5. Sioux Chief Manufacturing Company, Inc.
  - 6. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - 7. Tyler Pipe; Wade Div.
  - 8. Watts Drainage Products Inc.
  - 9. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 10. Or approved equal.
- D. Standard: ASSE 1010 or PDI-WH 201.
- E. Type: [Metal bellows] [Copper tube with piston].
- F. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

## 2.8 TRAP-SEAL PRIMER VALVES

- A. Supply-Type, Trap-Seal Primer Valves: Refer to schedule on Drawing P6.03.
- B. 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:
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. MIFAB, Inc.
  - 2. PPP Inc.
  - 3. Sioux Chief Manufacturing Company, Inc.
  - 4. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - 5. Watts Industries, Inc.; Water Products Div.
  - 6. Or approved equal.
- D. Standard: ASSE 1018.
- E. Pressure Rating: 125 psig minimum.
- F. Body: Bronze.

- G. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
- H. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
- I. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

## 2.9 TRAP-SEAL PRIMER SYSTEMS

- A. Trap-Seal Primer Systems: Refer to schedule on Drawing P6.03.
- B. 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:
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- D. Basis-of-Design Product: Subject to compliance with requirements or a comparable product by one of the following:
  - 1. PPP Inc.
  - 2. Standard: ASSE 1044,
  - 3. Piping: NPS 3/4, ASTM B 88, Type L (DN 20, ASTM B 88M, Type B); copper, water tubing.
  - 4. Cabinet: Recessed-mounting steel box with stainless-steel cover.
  - 5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
  - 6. Vacuum Breaker: ASSE 1001.
  - 7. Number Outlets: As needed.
  - 8. Size Outlets: NPS 1/2 (DN 15).
  - 9. Or approved equal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Revise remaining paragraphs and subparagraphs in this Article to include specific installation requirements.
- B. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- C. Install balancing valves in locations where they can easily be adjusted.
- D. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 6 Section "Rough Carpentry."
- E. Water hammer arresters in first paragraph below are best shown on water risers and details. Specifying number, size, and location here is difficult.
- F. Install water hammer arresters in water piping according to PDI-WH 201.
- G. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- H. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

- J. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

### 3.2 CONNECTIONS

- A. Drawings indicate general arrangement of piping and specialties.

### 3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Outlet boxes.
  - 2. Supply-type, trap-seal primer valves.
  - 3. Trap-seal primer systems.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 23 Section "Mechanical Identification."

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
  - 1. Test each system according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

### 3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119



## SECTION 221316 - SANITARY WASTE AND VENT PIPING

### 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 soil, waste, and vent piping inside the building:
  - 1. Pipe, tube, and fittings.
  - 2. Special pipe fittings.
  - 3. Encasement for underground metal piping.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures" and International Building Code – New Jersey Edition – Latest Edition

#### 1.4 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings:
  - 1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.
  - 2. Sovent Drainage System: Include plans, elevations, sections, and details.
- C. Field quality-control inspection and test reports.

#### 1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

## 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 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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

### 2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service and Extra-Heavy class(es).
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, hemp fiber.

### 2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Solvent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
- C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
  - 1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
    - a. Manufacturers:
      - 1) ANACO.
      - 2) Fernco, Inc.
      - 3) Ideal Div.; Stant Corp.
      - 4) Mission Rubber Co.
      - 5) Tyler Pipe; Soil Pipe Div.
      - 6) Charlotte Pipe & Foundry Co.
  - 2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
    - a. Manufacturers:
      - 1) ANACO.
      - 2) Clamp-All Corp.

- 3) Ideal Div.; Stant Corp.
- 4) Mission Rubber Co.
- 5) Tyler Pipe; Soil Pipe Div.
- 6) Charlotte Pipe & Foundry Co.
3. Heavy-Duty, Shielded, Cast-Iron Couplings: ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.
  - a. Manufacturers:
    - 1) MG Piping Products Co.

## 2.5 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
  1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- B. Hard Copper Tube: ASTM B 88, Types L (ASTM B 88M, Types B and C), water tube, drawn temper.
  1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
  3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- C. Soft Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.
  1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

## 2.6 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
  1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Solvent Cement: ASTM D 2564.
  1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.7 SPECIAL PIPE FITTINGS

- A. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
  - 1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Mission Rubber Co.
- B. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
  - 1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Dresser, Inc.; DMD Div.
    - c. EBAA Iron Sales, Inc.
    - d. Ford Meter Box Company, Inc. (The); Pipe Products Div.
    - e. JCM Industries, Inc.
    - f. Romac Industries, Inc.
    - g. Smith-Blair, Inc.
    - h. Viking Johnson.
  - 2. Center-Sleeve Material: Manufacturer's standard.
  - 3. Gasket Material: Natural or synthetic rubber.
  - 4. Metal Component Finish: Corrosion-resistant coating or material.
- C. Flexible Ball Joints: Ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile-iron gland, rubber gasket, and steel bolts.
  - 1. Manufacturers:
    - a. EBAA Iron Sales, Inc.
- D. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
  - 1. Manufacturers:
    - a. EBAA Iron Sales, Inc.
    - b. Romac Industries, Inc.
    - c. Star Pipe Products; Star Fittings Div.
- E. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
  - 1. Manufacturers:
    - a. SIGMA Corp.



## 2.8 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Description: ASTM A 674 or AWWA C105, high-density, crosslaminated PE film of 0.004-inch minimum thickness.
- B. Form: Sheet or tube.
- C. Color: Black.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- B. Aboveground, soil and waste piping (EXCEPT IN THE KITCHEN) shall be any of the following:
  - 1. Hubless cast-iron soil pipe and fittings and couplings; and hubless-coupling joints.
  - 2. Copper DWV tube, copper drainage fittings, and soldered joints.
  - 3. Solid-Wall Schedule 40 PVC Pipe with primed & cemented PVC socket fittings.
- C. Aboveground, soil and waste piping NPS 5 (DN 125) (EXCEPT IN THE KITCHEN) and larger shall be any of the following:
  - 1. Hubless cast-iron soil pipe and fittings shielded, stainless-steel couplings; and hubless-coupling joints.
  - 2. Solid-Wall Schedule 40 PVC Pipe with primed & cemented PVC socket fittings.
- D. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be any of the following:
  - 1. Hubless cast-iron soil pipe and fittings shielded, stainless-steel couplings; and hubless-coupling joints.
  - 2. Solid-Wall Schedule 40 PVC Pipe with primed & cemented PVC socket fittings.
- E. Aboveground, vent piping NPS 5 (DN 125) and larger shall be any of the following:
  - 1. Hubless cast-iron soil pipe and fittings shielded, stainless-steel couplings; and hubless-coupling joints.
  - 2. Solid-Wall Schedule 40 PVC Pipe with primed & cemented PVC socket fittings.
- F. Underground, soil, waste, and vent piping NPS 4 (DN 100) (EXCEPT IN THE KITCHEN) and smaller shall be any of the following:
  - 1. Service class, cast-iron bell and spigot type soil pipe with gasketed joints.
  - 2. Solid-Wall PVC Pipe with primed & cemented PVC socket fittings.
- G. Underground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:
  - 1. Service class, cast-iron bell and spigot type soil pipe with gasketed joints.
  - 2. Solid-Wall PVC Pipe with primed & cemented PVC socket fittings.
- H. Aboveground, waste piping in the Kitchen shall be:

1. Hubless cast-iron soil pipe and fittings shielded, stainless-steel couplings; and hubless-coupling joints.
- I. Aboveground, vent piping in the Kitchen shall be:
  1. Hubless cast-iron soil pipe and fittings shielded, stainless-steel couplings; and hubless-coupling joints.
  2. Solid-Wall PVC Pipe with primed & cemented PVC socket fittings.
- J. Underground, waste, and vent piping in the Kitchen shall be ONLY:
  1. Service class, cast-iron bell and spigot type soil pipe with gasketed joints.

### 3.2 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section 220501
- B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section 220501
- D. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.
- E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- H. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
  2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- I. Install engineered soil and waste drainage and vent piping systems as follows:
1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
  2. Solvent Drainage System: Comply with ASSE 1043 and solvent fitting manufacturer's written installation instructions.
  3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- K. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.
- L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section 220501
- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

### 3.4 VALVE INSTALLATION

- A. General valve installation requirements are specified in Division 22 Section "Valves."

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration Controls and Seismic Restraints."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports." Install the following:
1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  2. Install individual, straight, horizontal piping runs according to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches with 3/8-inch rod.
  2. NPS 3 (DN 80): 60 inches with 1/2-inch rod.
  3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches with 5/8-inch rod.
  4. NPS 6 (DN 150): 60 inches with 3/4-inch rod.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 (DN 32): 84 inches with 3/8-inch rod.
  2. NPS 1-1/2 (DN 40): 108 inches with 3/8-inch rod.
  3. NPS 2 (DN 50): 10 feet with 3/8-inch rod.
  4. NPS 2-1/2 (DN 65): 11 feet with 1/2-inch rod.
  5. NPS 3 (DN 80): 12 feet with 1/2-inch rod.
  6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet with 5/8-inch rod.
  7. NPS 6 (DN 150): 12 feet with 3/4-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 2 (DN 50): 84 inches with 3/8-inch rod.
  2. NPS 3 (DN 80): 96 inches with 1/2-inch rod.
  3. NPS 4 (DN 100): 108 inches with 1/2-inch rod.
  4. NPS 6 (DN 150): 10 feet with 5/8-inch rod.
- K. Install supports for vertical stainless-steel piping every 10 feet.
- L. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 (DN 32): 72 inches with 3/8-inch rod.
  2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches with 3/8-inch rod.
  3. NPS 2-1/2 (DN 65): 108 inches with 1/2-inch rod.
  4. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet with 1/2-inch rod.
  5. NPS 6 (DN 150): 10 feet with 5/8-inch rod.
- M. Install supports for vertical copper tubing every 10 feet.

- N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
  - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

### 3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack

openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

### 3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316

## SECTION 221319 – SANITARY WASTE PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following drainage piping specialties:
  - 1. Cleanouts.
  - 2. Floor drains.
  - 3. Miscellaneous drainage piping specialties.

#### 1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PUR: Polyurethane plastic.
- H. PVC: Polyvinyl chloride plastic.

#### 1.4 SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- B. Manufacturer Seismic Qualification Certification: Submit certification that all accessories, and components will withstand seismic forces defined in Division 22 Section "Plumbing Vibration and Seismic Controls." Include the following:
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

- a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

## 1.5 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. 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.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary and storm piping specialty components.

## 1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate size and location of roof penetrations.

## 1.7 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. Cultures: Provide 1-gal. bottles of bacteria culture recommended by manufacturer of FOG disposal systems equal to 200 percent of amount installed, but no fewer than 2 1-gal. bottles.

## PART 2 - PRODUCTS

### 2.1 CLEANOUTS

A. Metal Floor Cleanouts:

1. 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:



2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:
  - a. MIFAB, Inc.
  - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - c. Tyler Pipe; Wade Div.
  - d. Watts Drainage Products Inc.
  - e. Or approved equal.

B. Stainless Steel Wall Cleanouts:

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:
  - a. MIFAB, Inc.
  - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - c. Tyler Pipe; Wade Div.
  - d. Watts Drainage Products Inc.
  - e. Or approved equal.

## 2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:
  - a. MIFAB, Inc.
  - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - c. Tyler Pipe; Wade Div.
  - d. Watts Drainage Products Inc.
  - e. Or approved equal.
4. Standard: ASME A112.6.3 with backwater valve.
5. Pattern: Floor drain.
6. Outlet: Side.
7. Sediment Bucket: Refer to plumbing schedule.
8. Top or Strainer Material: Bronze.
9. Top of Body and Strainer Finish: Nickel bronze.
10. Top Shape: Round.

## 2.3 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
  2. Size: Same as connected waste piping [with increaser fitting of size indicated].
- B. Deep-Seal Traps:
1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
  2. Size: Same as connected waste piping.
    - a. NPS 2 (DN 50): 4-inch minimum water seal.
    - b. NPS 2-1/2 (DN 65) and Larger: 5-inch minimum water seal.
- C. Floor-Drain, Trap-Seal Primer Fittings:
1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
  2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.
- D. Air-Gap Fittings:
1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
  2. Body: Bronze or cast iron.
  3. Inlet: Opening in top of body.
  4. Outlet: Larger than inlet.
  5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.
- E. Sleeve Flashing Device:
1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend [1 inch (25 mm)] [2 inches (51 mm)] <Insert dimension> above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
  2. Size: As required for close fit to riser or stack piping.
- F. Stack Flashing Fittings:
1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
  2. Size: Same as connected stack vent or vent stack.
- G. Vent Caps:
1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
  2. Size: Same as connected stack vent or vent stack.
- H. Frost-Resistant Vent Terminals:
1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.

2. Design: To provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

I. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

J. Downspout Boots:

1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 (DN 100) outlet; and shop-applied bituminous coating.
2. Size: Inlet size to match downspout.
3. Description: ASTM A 74, Service class, hub-and-spigot, cast-iron soil pipe.
4. Size: Same as or larger than connected downspout.

K. Conductor Nozzles:

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
2. Size: Same as connected conductor.

## 2.4 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft.
2. Vent Pipe Flashing: 8 oz./sq. ft.

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Refer to Division 22 Section 220501 for piping joining materials, joint construction, and basic installation requirements.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### 3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

## SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

### 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. Residential, electric, storage, domestic-water heaters.
  - 2. Domestic-water heater accessories.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
  - 1. Wiring Diagrams: For power, signal, and control wiring.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For commercial domestic-water heaters, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Product Certificates: For each type of residential, electric, domestic-water heater, from manufacturer.
- C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Warranty: Sample of special warranty.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

## 1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

## 1.7 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including storage tank and supports.
    - b. Faulty operation of controls.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
  - 2. Warranty Periods: From date of Substantial Completion.
    - a. Residential, Electric, Storage, Domestic-Water Heaters:
      - 1) Storage Tank: Five years.
      - 2) Controls and Other Components: Two years.
    - b. Compression Tanks: Five years.

## PART 2 - PRODUCTS

### 2.1 RESIDENTIAL, ELECTRIC, DOMESTIC-WATER HEATERS

- A. Residential, Electric, Storage, Domestic-Water Heaters:
  - 1. Standard: UL 174.
  - 2. Storage-Tank Construction: Steel.
    - a. Tappings: ASME B1.20.1 pipe thread.
    - b. Pressure Rating: 150 psig (1035 kPa).

- c. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining material into tappings.
- 3. Factory-Installed Storage-Tank Appurtenances:
  - a. Anode Rod: Replaceable magnesium.
  - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
  - c. Drain Valve: ASSE 1005.
  - d. Insulation: Comply with ASHRAE 90.2.
  - e. Jacket: Steel, cylindrical, with enameled finish.
  - f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
  - g. Heating Elements: Two; electric, screw-in immersion type; wired for non-simultaneous operation unless otherwise indicated. Limited to 12 kW total.
  - h. Temperature Control: Adjustable thermostat.
  - i. Safety Control: High-temperature-limit cutoff device or system.
  - j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

## 2.2 DOMESTIC-WATER HEATER ACCESSORIES

- A. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.
- B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.
- C. Heat-Trap Fittings: ASHRAE 90.2.
- D. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig- (172.5-kPa-) maximum outlet pressure unless otherwise indicated.
- E. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- F. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.
- G. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
- H. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.
- I. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water. Refer to drawing for make and model

## 2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

- B. Hydrostatically test domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and re-inspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Residential, Electric, Domestic-Water Heater Mounting: Install residential, electric, domestic-water heaters on domestic-water heater mounting bracket.
  - 1. Maintain manufacturer's recommended clearances.
  - 2. Arrange units so controls and devices that require servicing are accessible.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 5. Anchor domestic-water heaters to substrate.
- B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
  - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 Retain first paragraph below if domestic-water heaters are required to withstand seismic design loads. Insert special requirements for seismic restraints here or detail on Drawings.
- C. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
- E. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- F. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- G. Fill electric, domestic-water heaters with water.



- H. Charge domestic-water compression tanks with air.

### 3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

### 3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and re-inspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain, electric, domestic-water heaters.

END OF SECTION 223300



## SECTION 224100 - PLUMBING FIXTURES

### 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. Faucets.
- 2. Lavatories.
- 3. Showers.
- 4. Kitchen sinks.
- 5. Water closets.
- 6. Toilet seats.
- 7. Supply fittings.
- 8. Waste fittings.

- B. Related Requirements:

- 1. Section 224213 "Commercial Water Closets."

#### 1.3 ACTION SUBMITTALS

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

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
- 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted plumbing fixtures.

- B. Sample Warranty: For special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For plumbing fixtures and faucets to include in emergency, operation, and operation and maintenance manuals.

## 1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures of unit shell.
    - b. Faulty operation of controls, blowers, pumps, heaters, and timers.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
  - 2. Warranty Applications of Shells: Five years from date of Substantial Completion.
  - 3. Warranty Period for Applications of Electronic Controls: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 REFER TO THE PLUMBING FIXTURE SCHEDULE FOR MAKE AND MODELS OF ALL FIXTURES.

### 2.2 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing-fixture installation.
- B. Examine walls, floors, cabinets, and counters for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install plumbing fixtures level and plumb according to roughing-in drawings.
- B. Install floor-mounted water closets on closet flange attachments to drainage piping.
- C. Install counter-mounting fixtures in and attached to casework.

- D. Install pedestal lavatories on pedestals and secured to wood blocking in wall.
- E. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
  - 1. Exception: Use ball or gate valves if supply stops are not specified with fixture. Comply with valve requirements specified in Section 220523.
- F. Install toilet seats on water closets.
- G. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- H. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- I. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes unless otherwise indicated.
- J. Set shower receptors in leveling bed of cement grout.
- K. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."
- L. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- M. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

### 3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

### 3.4 ADJUSTING

- A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

- B. Adjust water pressure at faucets to produce proper flow.

### 3.5 CLEANING AND PROTECTION

- A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.
- B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed plumbing fixtures and fittings.
- D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224100

## SECTION 224213 - COMMERCIAL WATER CLOSETS

### 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. Water closets.
  - 2. Flushometer valves.
  - 3. Toilet seats.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

### PART 2 - PRODUCTS

- 2.1 REFER TO THE PLUMBING FIXTURE SCHEDULE FOR MAKE AND MODEL OF ALL FIXTURES.

### PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

#### A. Water-Closet Installation:

- 1. Install level and plumb according to roughing-in drawings.
- 2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
- 3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

#### B. Support Installation:

- 1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
- 2. Use carrier supports with waste-fitting assembly and seal.
- 3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
- 4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

#### C. Flushometer-Valve Installation:

- 1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
- 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
- 3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
- 4. Install actuators in locations that are easy for people with disabilities to reach.
- 5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

#### D. Install toilet seats on water closets.

#### E. Wall Flange and Escutcheon Installation:

- 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
- 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
- 3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

#### F. Joint Sealing:

- 1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
- 2. Match sealant color to water-closet color.
- 3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."



### 3.3 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

### 3.4 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

### 3.5 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213



## SECTION 230000 – MECHANICAL SUMMARY OF WORK

### 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:
  - a. Work covered under Mechanical Contract.
  - b. Work under other contracts.
  - c. Use of premises.
  - d. Owner's occupancy requirements.
  - e. Specification formats and conventions.

- B. Related Sections include the following:

- a. Division 23 Sections.

#### 1.3 WORK COVERED UNDER MECHANICAL CONTRACT

- A. Provide all labor, materials, tools, machinery, equipment, and services necessary to complete the mechanical work under this contract. All systems and equipment shall be complete in every aspect and all items of material, equipment, and labor shall be provided for a fully operational system. Coordinate the work with work of other trades so as to resolve conflicts without impeding job progress. The mechanical work includes the following:

- B. MECHANICAL

- 1. The mechanical contractor shall furnish all labor, materials, equipment, rigging, appliances, tools and accessories required for providing, installing, connecting and testing the new mechanical system, associated work, controls, etc., in accordance with these specifications and the applicable drawings. The work includes:
    - a. Furnish and install new HV/HVAC mechanical equipment as scheduled on the plans, complete with new ductwork, piping, controls, electrical, etc. for a complete and operational system.
    - b. Furnish and install new split-DX VRF system as scheduled on the plans, complete with indoor and outdoor units, refrigerant piping, condensate drain piping, condensate pumps, insulation of all piping/ductwork, controls, electrical, etc. for a complete and operational system
    - c. Furnish and install new electric cabinet heaters, complete with wiring, thermostats, disconnect switches, etc. for a complete and operational system. Color to be selected by the owner

- d. Furnish and install new exhaust fans complete with supports, vibration isolators, fan switch, interlock wiring, backdraft dampers, etc. for a complete and operational system.
- e. All electrical work associated with new HV/HVAC system shall be performed by the Electrical Subcontractor. All control wiring will be by Mechanical Contractor. Refer to electrical drawings and Division 26 specification sections for information.
- f. Furnish and install new supply, return, exhaust and outdoor air ductwork as indicated on the drawings. All ductwork shall be galvanized steel construction.
- g. Provide high-efficiency electric motors for all new units.
- h. Furnish and install motorized dampers, volume dampers.
- i. Furnish and install flexible duct connectors at all duct connections to all HV/HVAC units.
- j. Provide fire stopping for all duct and piping penetrations through rated walls/slabs with pipe escutcheons
- k. All cutting, patching and alteration work shall be performed.
- l. All ductwork shall be properly fabricated, installed and supported as per SMACNA and ASHRAE guidelines
- m. Contractor to perform testing, adjusting and balancing (TAB) of the entire HV/HVAC system shown on the drawings, including all new HV/HVAC units, air outlets/inlets, etc. Submit four (4) sets of air and unit TAB reports for review.
- n. Provide testing, commissioning and start-up reports for all new mechanical/HV system installed in this project.
- o. Contractor to prepare as-built drawings of the entire mechanical/HV system. Submit four (4) sets of Operation and Maintenance Manuals.
- p. Provide color coded identification tags, identification markers and equipment tags for all equipment including HV/HVAC units, fans, ductwork, control valves, etc.
- q. Warranty: The entire system shall be warranted for a period of two (2) complete years from the date of acceptance by the owner, including all materials and labor components.
- r. Commissioning: The following is the commissioning scope of work for this project:
  - 1. There will not be a separate commissioning agent on this project. The architect/engineer will oversee the commissioning process.
  - 2. Submittals/Shop Drawings shall include detailed start up procedures.
  - 3. All equipment shall be factory tested before being shipped to project site.
  - 4. Perform functional performance test (FPT) of all HV/HVAC systems and equipment. Submit FPT Reports.

5. Provide detailed Start-Up Reports.
6. Trending: The building control system/energy management system, shall be monitored for the first year by the Controls Contractor, as well as by the Owner/Owner designated team for proper operation to optimize energy performance without compromising the comfort conditions.
7. The contractor shall certify in writing that the entire work was completed and systems are operational according to the contract documents, including calibration of instrumentation and controls.
8. Schedule, witness and document tests, inspections and systems startup. Inform architect/engineer sufficiently in advance to enable them to witness startup.
9. Perform testing, adjusting and balancing of all airside, waterside, and units/systems.
10. Compile test data, inspection reports and certificates and include them in the Systems Manual and Commissioning Report.
11. Certify date of acceptance and startup for each item of equipment for start of warranty periods.
12. Prepare as-built drawings. Submit four (4) sets of each, along with two (2) CD's (for drawings).
13. Submit six (6) sets of all documents.

#### 1.4 WORK UNDER OTHER CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

#### 1.5 USE OF PREMISES

- A. General: Each Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.
- B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  - a. Owner Occupancy: Allow for Owner occupancy of Project site and use by the public.
  - b. Driveways and Entrances: Keep driveways parking garage, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

## 1.6 OWNER'S OCCUPANCY REQUIREMENTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits, unless otherwise indicated.
  - a. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
  - b. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
  - a. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
  - b. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
  - c. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed.

## 1.7 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the CSI/CSC's "MasterFormat" numbering system.
  - a. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
  - b. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - a. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
  - b. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

- a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

## 1.8 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 230000





## SECTION 230500 – COMMON WORK RESULTS FOR HVAC

### 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. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Transition fittings.
  - 3. Dielectric fittings.
  - 4. Mechanical sleeve seals.
  - 5. Sleeves.
  - 6. Escutcheons.
  - 7. Grout.
  - 8. Equipment installation requirements common to equipment sections.
  - 9. Painting and finishing.
  - 10. Supports and anchorages.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- D. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures.
- E. The following are industry abbreviations for rubber materials:
  - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 2. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Transition fittings.
  - 2. Dielectric fittings.
  - 3. Mechanical sleeve seals.

4. Escutcheons.

B. Welding certificates.

## 1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

## 1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for 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, the manufacturers specified.

## 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

## 2.3 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, **1/8-inch** maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, **1/8 inch** thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## 2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for **250-psig** minimum working pressure at **180 deg F**.
  - 1. Acceptable Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Eclipse, Inc.
    - c. Epco Sales, Inc.
    - d. Hart Industries, International, Inc.
    - e. Watts Industries, Inc.; Water Products Div.
    - f. Zurn Industries, Inc.; Wilkins Div.

- g. Or Approved Equal.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
  - 1. Acceptable Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Epco Sales, Inc.
    - c. Watts Industries, Inc.; Water Products Div.
    - d. Or Approved Equal.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - 1. Acceptable Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Pipeline Seal and Insulator, Inc.
    - d. Or Approved Equal.
  - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
  - 1. Acceptable Manufacturers:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
    - c. Epco Sales, Inc.
    - d. Or Approved Equal.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
  - 1. Acceptable Manufacturers:
    - a. Perfection Corp.
    - b. Precision Plumbing Products, Inc.
    - c. Sioux Chief Manufacturing Co., Inc.
    - d. Victaulic Co. of America.
    - e. Or Approved Equal.

## 2.5 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Acceptable Manufacturers:
  - a. Advance Products & Systems, Inc.
  - b. Calpico, Inc.
  - c. Metraflex Co.
  - d. Pipeline Seal and Insulator, Inc.
  - e. Or Approved Equal.
2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.6 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped and smooth-outer surface with nailing flange for attaching to wooden forms.

## 2.7 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  1. Finish: Polished chrome-plated and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  1. Finish: Polished chrome-plated and rough brass.

- E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

## 2.8 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi , 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 MECHANICAL DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" for general demolition requirements and procedures.

### 3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.

- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
    - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
    - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
    - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
    - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
    - l. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
  - 2. Existing Piping: Use the following:
    - a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
    - b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and spring clips.
    - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
    - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
    - g. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
    - h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
    - i. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
    - j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
    - k. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- L. Sleeves are not required for core-drilled holes.
- M. Permanent sleeves are not required for holes formed by removable PE sleeves.

- N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas **2 inches** above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide **1/4-inch** annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. PVC Pipe Sleeves: For pipes smaller than **NPS 6**.
    - b. Steel Sheet Sleeves: For pipes **NPS 6** and larger, penetrating gypsum-board partitions.
- P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for **1-inch** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Install steel pipe for sleeves smaller than **6 inches** in diameter.
  - 2. Install cast-iron "wall pipes" for sleeves **6 inches** and larger in diameter.
  - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for **1-inch** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.



- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping **NPS 2** and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping **NPS 2-1/2** and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### 3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### 3.6 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 09 Sections "Interior Painting".
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1.

### 3.8 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout around anchors.
- G. Cure placed grout.

END OF SECTION 230500

## SECTION 230513 – COMMON MOTOR REQUIREMENTS FOR HVAC 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 general requirements for single phase and polyphase, general purpose, horizontal, small and medium, squirrel cage induction motors for use on ac power systems up to 600V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

#### 1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.

### PART 2 - PRODUCTS

#### 2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe duty motors.

#### 2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

#### 2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.

- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
  - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
  - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
  - 1. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

#### 2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse width modulated inverters.
  - 2. Energy and Premium Efficient Motors: Class B temperature rise; Class F insulation.
  - 3. Inverter Duty Motors: Class F temperature rise; Class H insulation.
  - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

#### 2.5 SINGLE PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent split capacitor.
  - 2. Split phase.

- 3. Capacitor start, inductor run.
- 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable torque, permanent split capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513



## SECTION 230529 – HANGERS AND SUPPORTS FOR HVAC PIPING AND 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. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.

- B. Related Sections:

1. Section 233113 "Metal Ducts" for duct hangers and supports.

#### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  3. Design seismic-restraint hangers and supports for piping and equipment.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Metal framing systems.
  - 3. Fiberglass strut systems.
  - 4. Pipe stands.
  - 5. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of trapeze hangers.
  - 2. Design Calculations: Calculate requirements for designing trapeze hangers.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

## 1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

## PART 2 - PRODUCTS

### 2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pre-galvanized or hot-dipped.
  - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
  - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
  - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.



## 2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

## 2.3 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or [ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

## 2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] [stainless-] steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 2.5 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
  - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
  - 2. Base: Stainless steel.
  - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

- 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

## 2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured.

- Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
  3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

- a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
- 4. Shield Dimensions for Pipe: Not less than the following:
  - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
  - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
  - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
  - d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
  - e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
- 5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
- 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

### 3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
  - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
  - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
  - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
  - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
  - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
  - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
  - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
  - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
  - 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
  - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  - 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  - 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
  18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.
  19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb (340 kg).
    - b. Medium (MSS Type 32): 1500 lb (680 kg).
    - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529



## SECTION 230553 – MECHANICAL IDENTIFICATION

### 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 mechanical identification materials and their installation:
  - 1. Equipment nameplates.
  - 2. Equipment markers.
  - 3. Equipment signs.
  - 4. Access panel and door markers.
  - 5. Pipe markers.
  - 6. Duct markers.
  - 7. Stencils.
  - 8. Warning tags.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Valve numbering scheme.

#### 1.4 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

#### 1.5 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
  - 1. Data:
    - a. Manufacturer, product name, model number, and serial number.
    - b. Capacity, operating and power characteristics, and essential data.
    - c. Labels of tested compliances.
  - 2. Location: Accessible and visible.
  - 3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
  - 1. Terminology: Match schedules as closely as possible.
  - 2. Data:
    - a. Name and plan number.
    - b. Equipment service.
    - c. Design capacity.
    - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
  - 3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
  - 1. Data: Instructions for operation of equipment and for safety procedures.
  - 2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
  - 3. Thickness: 1/8 inch, unless otherwise indicated.
  - 4. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
  - 5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
- D. Access Panel and Door Markers: 1/16-inch thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
  - 1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

### 2.2 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.
  2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
  3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
  4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
  5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Pre-tensioned Pipe Markers: Precoiled semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- C. Shaped Pipe Markers: Preformed semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.
- D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.
1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
  2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

## 2.3 DUCT IDENTIFICATION DEVICES

- A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

## 2.4 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.
1. Stencil Material: Metal or fiberboard, Aluminum, or Brass.
  2. Stencil Paint: Exterior, gloss, acrylic enamel black, unless otherwise indicated. Paint may be in pressurized spray-can form.
  3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1, unless otherwise indicated.

## 2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by Architect. Provide 5/32-inch hole for fastener.

1. Material: 0.032-inch thick brass or aluminum.
2. Material: 0.0375-inch thick stainless steel.
3. Material: 3/32-inch thick laminated plastic with 2 black surfaces and white inner layer.
4. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

## 2.6 VALVE SCHEDULES

- A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
  2. Frame: Extruded aluminum.
  3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

## 2.7 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
1. Size: 3 by 5-1/4 inches minimum.
  2. Fasteners: Brass grommet and wire.
  3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
  4. Color: Yellow background with black lettering.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

### 3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
1. Fuel-burning units, including boilers, furnaces, heaters, and stills.
  2. Heat exchangers, coils, evaporators, and similar equipment.
  3. Fans, blowers, primary balancing dampers, and mixing boxes.
  4. Packaged HV/HVAC (central-station and zone-type units), split HV/HVAC, indoor AHU's, etc.

- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
  3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
    - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    - b. Meters, gages, thermometers, and similar units.
    - c. Fuel-burning units, including boilers, furnaces, and heaters.
    - d. Heat exchangers, coils, and similar equipment.
    - e. Fans, blowers, primary balancing dampers, and mixing boxes.
    - f. Packaged HV/HVAC (central-station and zone-type units), split HV/HVAC, indoor AHU's, etc.
    - g. Strainers, filters, water-treatment systems, and similar equipment.
- C. Stenciled Equipment Marker Option: Stenciled markers may be provided instead of laminated-plastic equipment markers, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.
- D. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
1. Identify mechanical equipment with equipment markers in the following color codes:
    - a. Green: For cooling equipment and components.
    - b. Yellow: For heating equipment and components.
    - c. Green and Yellow or Orange: For combination cooling and heating equipment and components.
  2. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
  4. Include signs for the following general categories of equipment:
    - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    - b. Fuel-burning units, including boilers, furnaces, and heaters.
    - c. Pumps and similar motor-driven units.
    - d. Heat exchangers, coils, evaporators, and similar equipment.
    - e. Fans, blowers, primary balancing dampers, and mixing boxes.
    - f. Packaged HV/HVAC (central-station and zone-type units), split HV/HVAC, indoor AHU's, etc.
    - g. Strainers, filters, water-treatment systems, and similar equipment.

- E. Stenciled Equipment Sign Option: Stenciled signs may be provided instead of laminated-plastic equipment signs, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.
- F. Install access panel markers with screws on equipment access panels.

### 3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
  - 1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pre-tensioned pipe markers. Use size to ensure a tight fit.
  - 2. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape at least 3/4 inch wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
- B. Stenciled Pipe Marker Option: Stenciled markers may be provided instead of manufactured pipe markers, at Installer's option. Install stenciled pipe markers with painted, color-coded bands or rectangles complying with ASME A13.1 on each piping system.
  - 1. Identification Paint: Use for contrasting background.
  - 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

### 3.4 DUCT IDENTIFICATION

- A. Install duct markers with permanent adhesive on air ducts in the following color codes:
  - 1. Green: For cold-air supply ducts.
  - 2. Yellow: For hot-air supply ducts.
  - 3. Blue: For exhaust, outside, relief, return, and mixed-air ducts.
  - 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
  - 5. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

- B. Stenciled Duct Marker Option: Stenciled markers, showing service and direction of flow, may be provided instead of laminated-plastic duct markers, at Installer's option, if lettering larger than 1-inch high is needed for proper identification because of distance from normal location of required identification.
- C. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

### 3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

### 3.6 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

### 3.7 CLEANING

- A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION 230553





## SECTION 230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

### 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. Balancing Air Systems:
    - a. Constant-volume air systems.
  - 2. Additional Tests
    - a. Sound testing.
    - b. Vibration testing.
    - c. Duct leakage testing.
    - d. Controls verification.

#### 1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. T&B: Testing, adjusting, and balancing
- C. T&B Agency: An independent entity certified by AABC to perform testing and balancing work.
- D. TBE: AABC certified test and balance engineer.
- E. TBT: AABC certified test and balance technician.
- F. HVAC: Heating, ventilating, and air conditioning.
- G. BAS: Building automation systems.
- H. Contract documents: the mechanical drawings and test and balance specification
- I. NC: noise criteria
- J. RC: room criteria

#### 1.4 T&B INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation T&B of AABC certification of T&B agency and personnel, including a sample copy of the AABC "National Performance Guaranty." If not submitted within the timeframe specified, the engineer has the right to choose an AABC agency at the Contractor's expense.
- B. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit T&B strategies and step-by-step procedures as specified in "Preparation" Article.
- C. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article to be used and filled out by systems Installers verifying that systems are ready for T&B.
- D. Examination Report: Within 30 days of Contractor's Notice to Proceed, provide a summary report of the examination review required in Part 3 "Examination", if issues are discovered that may preclude the proper testing and balancing of the systems.
- E. Certified T&B reports: Within 14 days of completion of balancing work, submit AABC-certified T&B report.
  - 1. Submit one copy of the final T&B Report directly to the design professional of record. Provide five additional copies to the contractor.

#### 1.5 QUALITY ASSURANCE

- A. T&B Agency Qualifications: Engage a T&B entity certified by AABC.
  - 1. T&B Field Supervisor: Employee of the T&B Agency who is certified by AABC.
  - 2. T&B Technician: Employee of the T&B Agency and who is certified by AABC as a TBT.
- B. T&B Conference: If requested by the Engineer or Owner after approval of the T&B Agency's submittals, meet to develop a mutual understanding of the details. The T&B agency shall be provided a minimum of 14 days' advance notice of scheduled meeting time and location.
  - 1. Agenda Items:
    - a. The examination report.
    - b. The Strategies and Procedures plan.
    - c. Systems readiness checklists.
    - d. Coordination and cooperation of trades and subcontractors.
    - e. Coordination of documentation and communication flow.
- C. TBT shall perform the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified T&B reports.
  - 2. Certify that the T&B team complied with the approved T&B plan and the procedures specified and referenced in this Specification.
  - 3. Certify the T&B report.
- D. T&B Report Forms: Use approved forms submitted with the Strategies and Procedures Plan.

- E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in the "AABC National Standards for Total System Balance."

## 1.6 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire T&B period. Cooperate with Owner during T&B operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during T&B operations to minimize conflicts with Owner's operations.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 T&B AGENCY

- A. Subject to compliance with requirements, engage one of AABC certified T&B Agencies:

### 3.2 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper T&B of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Note the locations of devices that are not accessible for testing and balancing.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- E. Examine equipment performance data including fan and pump curves.
- F. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, clean permanent filters are installed, and equipment with functioning controls is ready for operation.
- G. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected, configured by the controls contractor, and functioning.
- H. Examine strainers to verify that mechanical contractor has replaced startup screens with permanent screens and that all strainers have been cleaned.
- I. Examine two-way valves for proper installation and function.

- J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- K. Examine air vents to verify that mechanical contractor has removed all air from all hydronic systems.

### 3.3 PREPARATION

- A. Prepare a T&B plan that includes the following:
  - 1. Equipment and systems to be tested.
  - 2. Strategies and step-by-step procedures for balancing the systems.
  - 3. Instrumentation to be used.
  - 4. Sample forms with specific identification for all equipment.
- B. Prepare system-readiness checklists, as described in the "AABC National Standards for Total System Balance," for use by systems installers in verifying system readiness for T&B. These shall include, at a minimum, the following:
  - 1. Airside:
    - a. Ductwork is complete with terminals installed.
    - b. Volume, smoke and fire dampers are open and functional.
    - c. Clean filters are installed.
    - d. Fans are operating, free of vibration, and rotating in correct direction.
    - e. Variable-frequency controllers' start-up is complete and safeties are verified.
    - f. Automatic temperature-control systems are operational.
    - g. Ceilings are installed.
    - h. Windows and doors are installed.
    - i. Suitable access to balancing devices and equipment is provided.

### 3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for T&B procedures.
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### 3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain approved submittals and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare single-line schematic diagram of systems for the purpose of identifying HVAC components.

- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- E. Verify that motor starters are equipped with properly sized thermal protection.
- F. Check condensate drains for proper connections and functioning.
- G. Check for proper sealing of air-handling-unit components.

### 3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow.
    - a. Set outside air, return air and relief air dampers for proper position that simulates minimum outdoor air conditions.
    - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
    - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
  - 2. Measure fan static pressures as follows:
    - a. Measure static pressure directly at the fan outlet or through the flexible connection.
    - b. Measure static pressure directly at the fan inlet or through the flexible connection.
    - c. Measure static pressure across each component that makes up the air-handling system.
    - d. Report any artificial loading of filters at the time static pressures are measured.
  - 3. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
  - 1. Measure airflow of submain and branch ducts.
  - 2. Adjust sub-main and branch duct volume dampers for specified airflow. Re-measure each sub-main and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
  - 1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
  - 2. Measure airflow at all inlets and outlets.
  - 3. Adjust each inlet and outlet for specified airflow.
  - 4. Re-measure each inlet and outlet after all have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm minimum outdoor air, return and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust, if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

### 3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports for pumps, coils and heat exchangers. Obtain approved submittals and any manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.

B. Verify that hydronic systems are ready for testing and balancing:

1. Check liquid level in expansion tank.
2. Check that makeup water-has adequate pressure to highest vent.
3. Check that control valves are in their proper position.
4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
5. Verify that motor starters are equipped with properly sized thermal protection.
6. Check that air has been purged from the system.

### 3.8 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phse/Hertz (Hz)
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test the manual bypass of the controller to prove proper operation.

### 3.9 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

### 3.10 FINAL TEST AND BALANCE REPORT

- A. The report shall be a complete record of the HVAC system performance, including conditions of operation, items outstanding, and any deviations found during the T&B process. The final report also provides a reference of actual operating conditions for the owner and/or operations personnel. All measurements and test results that appear in the reports must be made on site and dated by the AABC technicians or test and balance engineers.
- B. The report must be organized by systems and shall include the following information as a minimum:
  - 1. Title Page:
    - a. AABC certified company name
    - b. Company address
    - c. Company telephone number
    - d. Project identification number
    - e. Location
    - f. Project Architect
    - g. Project Engineer
    - h. Project Contractor
    - i. Project number
    - j. Date of report
    - k. AABC Certification Statement
    - l. Name, signature, and certification number of AABC TBE
  - 2. Table of Contents.
  - 3. AABC National Performance Guaranty.
  - 4. Report Summary:
    - a. The summary shall include a list of items that do not meet design tolerances, with information that may be considered in resolving deficiencies.
  - 5. Instrument List:
    - a. Type.
    - b. Manufacturer.
    - c. Model.
    - d. Serial Number.
    - e. Calibration Date.
  - 6. T&B Data:
    - a. Provide test data for specific systems and equipment as required by the most recent edition of the "AABC National Standards."
- C. One copy of the final test and balance report shall be sent directly to the engineer of record. Provide five additional copies to the contractor.

### 3.11 VERIFICATION OF T&B REPORT

- A. Final Verification:

1. After testing and balancing is complete and accurately documented in the final report, request that a final verification be made by Engineer.
2. The T&B Agency shall conduct the verification in the presence of Engineer.
3. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final verification, the testing and balancing shall be considered incomplete.

### 3.12 REVERIFICATION

- A. T&B Agency shall recheck all measurements and make adjustments as required to complete the balancing. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second verification.
- B. If the second verification also fails, Owner/Engineer may contact AABC Headquarters regarding the AABC National Performance Guaranty.

### 3.13 ADDITIONAL TESTS

#### A. Sound Testing

1. After the systems are balanced and the spaces are architecturally complete, read and record sound levels at 10 locations as designated by the Engineer of record.
2. Instrumentation:
  - a. The sound-testing meter shall be a portable, general-purpose testing meter consisting of a microphone, processing unit, and readout.
  - b. The sound-testing meter shall be capable of showing fluctuations at minimum and maximum levels, and measuring the equivalent continuous sound pressure level (LEQ).
  - c. The sound-testing meter must be capable of using 1/3 octave band filters to measure mid-frequencies from 31.5 HZ to 8000 HZ.
  - d. The accuracy of the sound-testing meter shall be  $\pm 1$  decibel.
3. Test Procedures
  - a. Perform test at the quietest background noise period. Note any cause of unpreventable sound that may affect the test outcome.
  - b. Equipment should be operating at design values.
  - c. Calibrate the sound-testing meter prior to taking measurements.
  - d. Use a microphone suitable for the type of noise levels measured that is compatible with the meter. Provide a windshield for outside or in-duct measurements.
  - e. Record a set of background measurements in dB(A), and sound pressure levels in the eight un-weighted octave bands [63 HZ to 8000 HZ (NC)] with the equipment off.
  - f. Take sound readings in dB(A), and sound pressure levels in the eight un-weighted octave bands [63 HZ to 8000 HZ (NC)] with the equipment on.



- g. Take readings no closer than 3' from a wall or from the operating equipment, and approximately 5' from the floor, with the meter held or mounted on a tripod.
    - h. For outdoor measurements, move the sound-testing meter slowly and scan the area that has the greatest exposure to the noise source being tested. (This type of reading is generally performed using the A-Weighted scale).
  - 4. Reporting
    - a. The report must record: the location, the system tested, the dB(A) reading, and the sound pressure level in each octave band with equipment on and off.
    - b. Plot all the sound pressure levels on the NC work sheet, with the equipment on and off.
- B. Vibration Testing:
  - 1. After the systems are balanced and the spaces are architecturally complete, read and record vibration levels on all equipment with motor horsepower equal to or greater than 10 hp.
  - 2. Instrumentation:
    - a. The vibration meter should be portable, battery-operated, and microprocessor-controlled, with or without a built-in printer.
    - b. The meter shall automatically identify engineering units, filter bandwidth, amplitude and frequency scale values.
    - c. The meter shall be able to measure machine vibration displacement in mils of deflection, velocity in inches per second, and acceleration in inches per second squared.
  - 3. Test Procedures:
    - a. Verify that the vibration meter calibration date is current before taking readings.
    - b. To ensure accurate readings, verify that the accelerometer has a clean, flat surface and is mounted properly.
    - c. With the unit running, set up the vibration meter in a safe, secure location. Connect the transducer to the meter with the proper cables. Hold the magnetic tip of the transducer on top of the bearing, and measure the unit in mils of deflection. Record the measurement, then move the transducer to the side of the bearing, and record in mils of deflection. Record an axial reading in mils of deflection by holding the nonmagnetic, pointed transducer tip on the end of the shaft.
    - d. Change the vibration meter to velocity (inches per second) measurements. Repeat and record the above measurements.
    - e. Record the CPM or the RPM.
    - f. Read each bearing on the motor, fan, and/or pump as required. Track and record vibration levels from the rotating component through the casing to the base.
  - 4. Reporting
    - a. The report must record the location and the system tested.
    - b. Include horizontal-vertical-axial measurements for all tests.
    - c. Verify that vibration limits follow specifications, or, if not specified, follow the "General Machinery Vibration Severity Chart" or "Vibration Acceleration General Severity Chart" from the AABC National Standards. Acceptable levels of vibration are normally "Smooth" to "Good."
    - d. Include in the report the Machinery Vibration Severity Chart, with conditions plotted.

C. Duct Leakage Testing:

1. Witness the duct pressure testing performed by the mechanical/installing contractor.
2. Verify that proper test methods are used and that leakage rates are within specified tolerances.
3. Report any deficiencies observed.

D. Controls Verification

1. In conjunction with system balancing perform the following:
  - a. Work with the temperature control contractor to ensure the system is operating within the design limitations, and gain a mutual understanding of intended control performance.
  - b. Confirm that the sequences of operation are in compliance with the approved drawings.
  - c. Verify that controllers are calibrated and function as intended.
  - d. Verify that controller setpoints are as specified.
  - e. Verify the operation of lockout or interlock systems.
  - f. Verify the operation of all valve and damper actuators.
  - g. Verify that all controlled devices are properly installed and connected to the correct controller.
  - h. Verify that all controlled devices travel freely and are in the position indicated by the controller: open, closed, or modulating.
  - i. Verify the location and installation of all sensors to ensure they will sense only the intended temperatures, humidities, or pressures.
2. Reporting
  - a. The report shall include a summary of verifications performed, remaining deficiencies, and any variations from specified conditions.

END OF SECTION 230593

## SECTION 230719 – PIPING INSULATION

### 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 insulating the following HVAC piping systems:
  - 1. Refrigerant Piping.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## 1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

## 1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
  - 1. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.
- C. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Block Insulation: ASTM C 552, Type I.
  - 2. Special-Shaped Insulation: ASTM C 552, Type III.
  - 3. Board Insulation: ASTM C 552, Type IV.
  - 4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
  - 5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
  - 6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- D. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, with factory-applied FSK jacket/FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- E. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

- F. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory-applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.
- G. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ/FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).
  - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Phenolic and Polyisocyanurate Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).
  - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- F. PVC Jacket Adhesive: Compatible with PVC jacket.
1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
  2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
  3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  4. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
  2. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
  3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
  4. Color: White.
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
  2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
  3. Solids Content: 60 percent by volume and 66 percent by weight.
  4. Color: White.

## 2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
  3. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
  4. Color: White.

## 2.5 SEALANTS

- A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
  2. Permanently flexible, elastomeric sealant.
  3. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
  4. Color: White or gray.
  5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. FSK and Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
  2. Fire- and water-resistant, flexible, elastomeric sealant.
  3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
  4. Color: Aluminum.
  5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
  2. Fire- and water-resistant, flexible, elastomeric sealant.
  3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
  4. Color: White.
  5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
  4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
  5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms (0.86 metric perms) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

## 2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  - 1. Adhesive: As recommended by jacket material manufacturer.
  - 2. Color: Color-code jackets based on system.
  - 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

## 2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. Width: 3 inches (75 mm).
  - 2. Thickness: 11.5 mils (0.29 mm).
  - 3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
  - 4. Elongation: 2 percent.
  - 5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
  - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  - 1. Width: 3 inches (75 mm).
  - 2. Thickness: 6.5 mils (0.16 mm).
  - 3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
  - 4. Elongation: 2 percent.
  - 5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
  - 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
  - 1. Width: 2 inches (50 mm).
  - 2. Thickness: 6 mils (0.15 mm).
  - 3. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
  - 4. Elongation: 500 percent.
  - 5. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
  - 1. Width: 2 inches (50 mm).
  - 2. Thickness: 3.7 mils (0.093 mm).
  - 3. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
  - 4. Elongation: 5 percent.
  - 5. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

## 2.9 SECUREMENTS

- A. Bands:



1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with [wing seal] [or] [closed seal].
  2. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
- C. Wire: 0.080-inch (2.0-mm) nickel-copper alloy soft-annealed, galvanized steel.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
  3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
- C. Insulation Installation at Floor Penetrations:
  1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies.

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

### 3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

### 3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  1. Below-grade piping.
  2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.11 INDOOR PIPING INSULATION SCHEDULE

#### A. OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Refer to sheet M0.01 for materials and thicknesses.
- C. Piping, Exposed:
  1. Aluminum, Smooth: 0.016 inch thick.

END OF SECTION 230719





## SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes control sequences for HVAC systems, subsystems, & equipment.

#### 1.2 RELATED DOCUMENTS

- A. Drawings & general provisions of the Contract, including General and Supplementary Conditions & Division 01 Specification Sections, apply to this Section.

#### 1.3 COORDINATED SEQUENCES & ATC DIAGRAMS

- A. Project ATC Diagrams: The Sequences of Operations detailed below are predicated on the specific Project ATC diagrams. Reference the ATC Diagrams for the Unit configuration, ATC control devices, point types & locations for each device.
- B. Control Sequence Descriptions: The control sequences below describe all necessary equipment operation including those operations that are provided by the HVAC Equipment Unit manufacturers (UM) & those as part of the Automatic Temperature Controls system (ATC). Due to the nature of the project, the control sequences will require field adjustment and modification. The ATC contractor shall provide all modifications to the sequences as requested by the MEP during the commissioning of the BMS.

#### 1.4 RESPONSIBILITIES

- A. Automatic Temperature Control (ATC) Contractor's Responsibilities: The ATC contractor (ATC) shall provide, field install & wire all necessary software & hardware, wiring, & computing equipment in compliance with this specification. The ATC contractor shall also provide programming, interface design, startup services by competent technicians that regularly employed by the ATC contractor with full responsibility for proper operation of the control system including debugging & proper calibration of each component in the entire system. The ATC contractor (ATC) shall provide power supply wiring to all external control panels, actuators (valves, dampers, etc.), including low voltage transformers, including the power for devices required for operation of BACnet communication as provided as part of complete HVAC Equipment Unit Manufacturer provided BACnet packaged.

#### 1.5 MAKE-UP AIR UNIT

- A. "Unoccupied Operation" – In the unoccupied mode, the supply fan shall be indexed off, the outside air damper shall modulate closed, based space temperature. If the space temperature falls below the adjustable unoccupied heating setpoint, the fan shall cycle OFF and the outside air damper shall remain closed.
- B. Transition from Unoccupied to Occupied – When the units' transition from unoccupied to occupied mode, morning warm-up (or ventilation) and random start routines shall be activated.

- C. Morning Warm-up – When there is a call for heating and the zone temperature is two (2) degrees off setpoint, a morning warm-up sequence shall be initiated. During morning warm-up, the fan shall be turned on, the outside air damper shall open.
- D. Morning Ventilation only – When the morning ventilation is initiated the unit shall operate in the turn propane gas off and fan shall continue to provide ventilation.
- E. Occupied Operation – In the occupied mode the fan shall start and run continuously. The fan status shall be monitored via a current switch and outside air damper shall remain open.
- F. Heating Mode – The outside air damper shall be 100% open. A supply air temperature sensor shall provide a low limit function and prevent the supply air temperature from falling below 60 degrees. A low limit controller will be located on the discharge side of the heating furnace. The furnace will modulate to discharge air temperature to maintain set point temperature, adj. If the temperature drops below the low limit controller setting (38 degrees) the fan shall stop and the outside air damper shall close, and the central control panel shall receive an alarm.

## 1.6 HEAT PUMP AC UNITS

- A. The HP/AC Monitoring Manufacturer (UM) shall provide a BACnet MS/TP communications card; all time to coordinate the integration to the BMS. The ATC contractor (ATC) shall provide the BACnet MS/TP communications wiring to the CRAC BACnet MS/TP communications board; provide all time to integrate the BACnet points.
- B. Scheduling: The HP/AC Monitoring shall be enabled (ENABLE) from the BMS
- C. Control: A Unit manufacturer Temperature (TEMP) and Humidity (RH) sensors shall monitor and control the space conditions through the unit's own internal controls. A Liquid Detection sensor (LDS) mounted in the drip pan shall be hard-wired to shut down the HP/AC Monitoring upon detection of liquid.
- D. Monitoring and Integration: A BMS DDC Space Temperature sensor (RMT) and Humidity sensor (RMRH) shall monitor the space conditions. The BMS shall monitor the alarm status (ALARM) of the CRAC through both a hard-wired connection and BACnet integration.
- E. Operator and Graphical User Interface requirements: The Building Management System Control Diagrams and the tables below shall provide for Operator Control of the HVAC equipment through an accurate depiction of the devices within the unit, along with the I/O points, parameters and alarms shall be displayed on a customized 3-dimensional web-based graphic.

### 1. Input/Output Points:

HP/AC Monitoring	I/O Points						
Point Name/Description/Legend X = DDC I/O L = Local Control A = Adjustable O = Override	AI	AO	BI	BO	Trend	GUI	Device
HP/AC Monitoring Enable				X	X	X	
Space Temperature (RMT)	X				X	X	TS-W
Space Humidity (RMRH)	X				X	X	RH-W
CRAC Alarm (ALARM)			X		X	X	
Analog Trends shall record data samples every 5 minutes, unless noted otherwise. Binary Trends shall record data samples every Change of Value (COV)							

### 2. Control Parameters and Settings

HP/AC Monitoring	Parameters and Settings
------------------	-------------------------

Parameter Name/Description X = Display on GUI C = Concealed A = Adjustable	AV	Trend	GUI	Initial-Setting
Setpoint and/or Parameters	A	X	C	Alarm settings
Alarm Reset	A	X	X	
Analog Trends shall record data samples every 5 minutes, unless noted otherwise. Binary Trends shall record data samples every Change of Value (COV)				

### 3. Alarms

HP/AC Monitoring	Alarms and Conditions		
Alarm Name	Point	Normal	Alarm
Unit Alarms	BACnet	As applicable	As applicable

## 1.7 ELECTRIC BASEBOARD BB, AND IN-WALL CABINET HEATER ECH

- A. Electric Wall Heaters ECH-1
  - 1. Service: As shown on the drawings.
  - 2. Integral thermostat shall cycle resistance heating, element to maintain space set point temperature. F.
- B. (BB) Electric Baseboard Heaters
  - 1. Service: As shown on the drawings. Various areas
  - 2. Integral thermostat shall cycle resistance heating, element to maintain space set point temperature.

## 1.8 EXHAUST FANS EF-1

- A. "Occupied Mode" Exhaust fan shall be interlock with MAU to relief outdoor air. When MAU is either providing ventilation or heating/ventilation the EF-1 shall be on.
- B. "Unoccupied Mode" When MAU is off, the EF-1 shall be commanded. The fan has a barometric damper to close when fan is off.

## 1.9 EXHAUST FANS EF-2

- A. The exhaust fan shall run continuously, 24 hours per day. The fan will have a switch to turn off the system. The fan switch will be located in the Janitor's closet.

## 1.10 COMMISSIONING

- A. Startup: The ATC system shall be set up & checked by factory trained competent technicians skilled in the setting & adjustment of the ATC equipment used in this project. The technicians are to be experienced in the type of HVAC systems associated with this project.
- B. Demonstration: At the completion of the commissioning, The ATC contractor (ATC) shall: demonstrate the sequence of operations for each system to the Architect or representative.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993

## SECTION 232300 – REFRIGERANT PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes refrigerant piping used for air conditioning applications.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
  - 1. Suction Lines for Air Conditioning Applications: 300 psig.
  - 2. Suction Lines for Heat Pump Applications: 535 psig.
  - 3. Hot Gas and Liquid Lines: 535 psig.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
  - 1. Thermostatic expansion valves.
  - 2. Solenoid valves.
  - 3. Filter dryers.
  - 4. Strainers.
  - 5. Pressure-regulating valves.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
  - 1. Shop Drawing Scale: 1/4 inch equals 1 foot.
  - 2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
- C. Welding certificates.

- D. Field quality control test reports.
- E. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

#### 1.6 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

### PART 2 - PRODUCTS

#### 2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.

#### 2.2 VALVES AND SPECIALTIES

- A. Diaphragm Packless Valves:
  - 1. Body and Bonnet: Forged brass or cast bronze; globe design with straight through or angle pattern.
  - 2. Diaphragm: Phosphor bronze and stainless steel with stainless steel spring.
  - 3. Operator: Rising stem and hand wheel.
  - 4. Seat: Nylon.
  - 5. End Connections: Socket, union, or flanged.
  - 6. Working Pressure Rating: 500 psig.
  - 7. Maximum Operating Temperature: 275 deg F.
- B. Packed Angle Valves:

1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:

1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. Manual Opening Stem: Seal cap, plated steel stem, and graphite seal.
6. End Connections: Socket, union, threaded, or flanged.
7. Maximum Opening Pressure: 0.50 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 275 deg F.

D. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.

4. End Connections: Threaded.
  5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
  6. Working Pressure Rating: 400 psig.
  7. Maximum Operating Temperature: 240 deg F.
  8. Manual operator.
- F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
  2. Piston, Closing Spring, and Seat Insert: Stainless steel.
  3. Seat Disc: Polytetrafluoroethylene.
  4. End Connections: Threaded.
  5. Working Pressure Rating: 400 psig.
  6. Maximum Operating Temperature: 240 deg F.
- G. Thermostatic Expansion Valves: Comply with ARI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
  2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
  3. Packing and Gaskets: Non-asbestos.
  4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
  5. Suction Temperature: 40 deg F.
  6. Superheat: Adjustable.
  7. Reverse-flow option (for heat pump applications).
  8. End Connections: Socket, flare, or threaded union.
  9. Working Pressure Rating: 700 psig.
- H. Replaceable-Core Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted steel shell with ductile iron cover, stainless steel screws, and neoprene gaskets.
  2. Filter Media: 10 micron, pleated with integral end rings; stainless steel support.
  3. Desiccant Media: Activated alumina.



4. Designed for reverse flow (for heat pump applications).
  5. End Connections: Socket.
  6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
  7. Maximum Pressure Loss: 2 psig.
  8. Working Pressure Rating: 500 psig.
  9. Maximum Operating Temperature: 240 deg F.
- I. Permanent Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted steel shell.
  2. Filter Media: 10 micron, pleated with integral end rings; stainless steel support.
  3. Desiccant Media: Activated alumina.
  4. Designed for reverse flow (for heat pump applications).
  5. End Connections: Socket.
  6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
  7. Maximum Pressure Loss: 2 psig.
  8. Working Pressure Rating: 500 psig.
  9. Maximum Operating Temperature: 240 deg F.

## 2.3 REFRIGERANTS

- 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. Atofina Chemicals, Inc.
  2. DuPont Company; Fluorochemicals Div.
  3. Honeywell, Inc.; Genetron Refrigerants.
  4. INEOS Fluor Americas LLC.
- B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines NPS 3-1/2 and Smaller for Conventional Air Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

- B. Hot Gas and Liquid Lines and Suction Lines for Heat Pump Applications: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- C. Safety Relief Valve Discharge Piping: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

### 3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install packed-angle valves in suction and discharge lines of compressor.
- B. Install service valves for gage taps at inlet and outlet of hot gas bypass valves and strainers if they are not an integral part of valves and strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install packed-angle valves on inlet and outlet side of filter dryers.
- E. Install thermostatic expansion valves as close as possible to distributors on evaporators.
  - 1. Install valve so diaphragm case is warmer than bulb.
  - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
  - 3. If external equalizer lines are required, make connection where it will reflect suction line pressure at bulb location.
- F. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety relief valve discharge line to outside according to ASHRAE 15.
- G. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- H. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
  - 1. Solenoid valves.
  - 2. Thermostatic expansion valves.
  - 3. Hot gas bypass valves.
  - 4. Compressor.
- I. Install filter dryers in liquid line between compressor and thermostatic expansion valve and in the suction line at the compressor.
- J. Install receivers sized to accommodate pump-down charge.

### 3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction

loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping adjacent to machines to allow service and maintenance.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- J. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels if valves or equipment requiring maintenance is concealed behind finished surfaces.
- K. Slope refrigerant piping as follows:
  - 1. Install horizontal hot gas discharge piping with a uniform slope downward away from compressor.
  - 2. Install horizontal suction lines with a uniform slope downward to compressor.
  - 3. Liquid lines may be installed level.
- L. When brazing or soldering, remove solenoid valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion valve bulb.
- M. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- N. Install escutcheons for piping penetrations of walls, ceilings, and floors.

### 3.4 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
  - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
  - 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.
- F. Welded Joints: Construct joints according to AWS D10.12/D10.12M.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Division 23 Section, "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
  - 2. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
  - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  - 8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. Comply with ASME B31.5, Chapter VI.

2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure. Test piping in accordance with the Mechanical Code of New York State.
3. Test high and low pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
  - a. Fill system with nitrogen to the required test pressure.
  - b. System shall maintain test pressure at the manifold gage throughout duration of test.
  - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
  - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

### 3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
  1. Install core in filter dryers after leak test but before evacuation.
  2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
  3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
  4. Charge system with a new filter-dryer core in charging line.

### 3.8 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high and low pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set point temperature of air conditioning or chilled water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
  1. Open shutoff valves in condenser water circuit.
  2. Verify that compressor oil level is correct.
  3. Open compressor suction and discharge valves.
  4. Open refrigerant valves except bypass valves that are used for other purposes.
  5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

## SECTION 233113 – METAL DUCTS

### 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 metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg (minus 500 to plus 2500 Pa). Metal ducts include the following:
  - 1. Rectangular ducts and fittings.
  - 2. Single-wall round spiral-seam ducts and formed fittings.
  - 3. Sheet metal materials.
  - 4. Sealants and gaskets.
  - 5. Hangers and supports.
  - 6. Seismic-restraint devices.
- B. Related Sections include the following:
  - 1. Section 230593 "Testing, Adjusting, and Balancing for HVACR" for testing, adjusting, and balancing requirements for metal ducts.
  - 2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

#### 1.3 DEFINITIONS

- A. NUSIG: National Uniform Seismic Installation Guidelines.

#### 1.4 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

#### 1.5 SUBMITTALS

- A. Shop Drawings: CAD-generated and drawn to 1/4 inch equals 1 foot. Show fabrication and installation details for metal ducts.

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
  2. Duct layout indicating sizes and pressure classes.
  3. Elevations of top and bottom of ducts.
  4. Dimensions of main duct runs from building grid lines.
  5. Fittings.
  6. Reinforcement and spacing.
  7. Seam and joint construction.
  8. Penetrations through fire-rated and other partitions.
  9. Equipment installation based on equipment being used on Project.
  10. Duct accessories, including access doors and panels.
  11. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
1. Ceiling suspension assembly members.
  2. Other systems installed in same space as ducts.
  3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
  4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- C. Welding certificates.
- D. Field quality-control test reports.

## 1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code-Steel," for hangers and supports and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. Compliance: Mechanical Code 2015 of New York State.

## 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 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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.



## 2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.
  - 2. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.4 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, matte finish for exposed ducts.
- D. Aluminum Sheets: ASTM B 209 (ASTM B 209M), alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

## 2.5 SEALANT MATERIALS

- A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.
- B. Joint and Seam Tape: 2 inches (50 mm) wide; glass-fiber-reinforced fabric.
- C. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
- D. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.
- E. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.
- F. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
- G. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

## 2.6 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.

2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
- B. Hanger Materials: Galvanized sheet steel or threaded steel rod.
1. Hangers Installed in Corrosive Atmospheres: Electro-galvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
  2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
  3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
  3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.

## 2.7 SEISMIC-RESTRAINT DEVICES

- A. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by [an evaluation service member of the ICC Evaluation Service] [an agency acceptable to authorities having jurisdiction].
1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- B. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- C. Restraint Cables: [ASTM A 603, galvanized] [ASTM A 492, stainless]-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
- D. Hanger Rod Stiffener: [Steel tube or steel slotted-support-system sleeve with internally bolted connections] [Reinforcing steel angle clamped] to hanger rod.
- E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

## 2.8 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and

complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
  2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Nexus Inc.
    - c. Ward Industries, Inc.
    - d. McGill AirFlow LLC.
    - e. Or Approved Equal.
- C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.
1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Lockformer.
    - c. McGill AirFlow LLC.
    - d. SEMCO LLC
    - e. Or Approved Equal.

## 2.9 ROUND DUCT AND FITTING FABRICATION (WHERE INDICATED ON DRAWINGS)

- A. Round, Longitudinal- and Spiral Lock-Seam Ducts: Fabricate exhaust air ducts of aluminum according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
1. Manufacturers:
    - a. McGill AirFlow Corporation.
    - b. SEMCO Incorporated.
    - c. Ductmate Industries, Inc.
    - d. Spiral Manufacturing Co.
    - e. Or Approved Equal.
- B. Duct Joints:
1. Ducts up to 20 Inches (500 mm) in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
  2. Ducts 21 to 72 Inches (535 to 1830 mm) in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
  3. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.

- a. Manufacturers:
  - 1) Ductmate Industries, Inc.
  - 2) Lindab Inc.
  - 3) SEMCO Incorporated.
  - 4) McGill AirFlow Corporation.
  - 5) Or Approved Equal.
- C. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.
- D. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- E. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
  - 1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
  - 2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg (minus 500 to plus 500 Pa):
    - a. Ducts 3 to 36 Inches (75 to 915 mm) in Diameter: 0.034 inch (0.85 mm).
  - 3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg (500 to 2500 Pa):
    - a. Ducts 3 to 26 Inches (75 to 660 mm) in Diameter: 0.034 inch (0.85 mm).
  - 4. Round Elbows 8 Inches (200 mm) and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
  - 5. Round Elbows 9 through 14 Inches (225 through 355 mm) in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
  - 6. Die-Formed Elbows for Sizes through 8 Inches (200 mm) in Diameter and All Pressures 0.040 inch (1.0 mm) thick with 2-piece welded construction.
  - 7. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
  - 8. Pleated Elbows for Sizes through 14 Inches (355 mm) in Diameter and Pressures through 10-Inch wg (2500 Pa): 0.022 inch (0.55 mm).

## PART 3 - EXECUTION

### 3.1 DUCT APPLICATIONS

- A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
  - 1. Return Ducts (Negative Pressure): 2 inch wg.
  - 2. Exhaust Ducts (Negative Pressure): 2-inch wg.
- B. All ducts shall be galvanized steel and air intake shall be heavy gauge aluminum construction.

### 3.2 DUCT INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Install round ducts in lengths not less than 12 feet (3.7 m) unless interrupted by fittings.
- C. Install ducts with fewest possible joints.
- D. Install fabricated fittings for changes in directions, size, and shape and for connections.
- E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches (300 mm), with a minimum of 3 screws in each coupling.
- F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
- I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches (38 mm).

- N. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Refer to SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
- O. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."
- P. Paint interiors of metal ducts, that do not have duct liner, for 24 inches (600 mm) upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 painting Sections.

### 3.3 SEAM AND JOINT SEALING

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.
  - 1. For pressure classes lower than 2-inch wg (500 Pa), seal transverse joints.
- B. Seal ducts before external insulation is applied.

### 3.4 HANGING AND SUPPORTING

- A. Support horizontal ducts within 24 inches (600 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.
- B. Support vertical ducts at maximum intervals of 16 feet (5 m) and at each floor.
- C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- D. Install concrete inserts before placing concrete.
- E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

### 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors according to Division 23 Section "Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.6 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:

1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (500 Pa) (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg (500 to 2500 Pa).
4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

### 3.7 CLEANING NEW SYSTEMS

- A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.
- B. Use service openings, as required, for physical and mechanical entry and for inspection.
  1. Create other openings to comply with duct standards.
  2. Disconnect flexible ducts as needed for cleaning and inspection.
  3. Remove and reinstall ceiling sections to gain access during the cleaning process.
- C. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.
- D. Clean the following metal duct systems by removing surface contaminants and deposits:
  1. Air outlets and inlets (registers, grilles, and diffusers).
  2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
  3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
  4. Coils and related components.
  5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
  6. Supply-air ducts, dampers, actuators, and turning vanes.
- E. Mechanical Cleaning Methodology:
  1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
  2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
  3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts or duct accessories.
- F. Cleanliness Verification:



1. Visually inspect metal ducts for contaminants.
2. Where contaminants are discovered, re-clean and reinspect ducts.

END OF SECTION 233113



## SECTION 233300 – AIR DUCT ACCESSORIES

### 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. Manual volume dampers.
  - 2. Control dampers.
  - 3. Flange connectors.
  - 4. Turning vanes.
  - 5. Flexible connectors.
  - 6. Flexible ducts.

#### 1.3 ACTION SUBMITTALS

- A. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
  - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
    - a. Special fittings.
    - b. Manual volume damper installations.
    - c. Control-damper installations.
    - d. Fire-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- B. Source quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

### 2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G90 (Z275).
- B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- C. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

### 2.3 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
  - 1. Standard leakage rating, with linkage outside airstream.
  - 2. Suitable for horizontal or vertical applications.
  - 3. Frames:
    - a. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
    - b. Mitered and welded corners.
    - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
  - 4. Blades:
    - a. Multiple or single blade.
    - b. Parallel- or opposed-blade design.
    - c. Stiffen damper blades for stability.
    - d. Galvanized-steel, 0.064 inch (1.62 mm) thick.
  - 5. Blade Axles: Galvanized steel.
  - 6. Bearings:
    - a. Oil-impregnated bronze.
    - b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
  - 7. Tie Bars and Brackets: Galvanized steel.
- B. Low-Leakage, Steel, Manual Volume Dampers:

1. Comply with AMCA 500-D testing for damper rating.
2. Low-leakage rating with linkage outside airstream and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
3. Suitable for horizontal or vertical applications.
4. Frames:
  - a. Angle shaped.
  - b. 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
  - c. Mitered and welded corners.
  - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
  - a. Multiple or single blade.
  - b. Parallel- or opposed-blade design.
  - c. Stiffen damper blades for stability.
  - d. Galvanized, roll-formed steel, 0.064 inch (1.62 mm) thick.
6. Blade Axles: Galvanized steel.
7. Bearings:
  - a. Oil-impregnated bronze.
  - b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Blade Seals: Neoprene.
9. Jamb Seals: Cambered aluminum.
10. Tie Bars and Brackets: Galvanized steel.
11. Accessories:
  - a. Include locking device to hold single-blade dampers in a fixed position without vibration.

## 2.4 FLANGE CONNECTORS

- A. Description: roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- B. Material: Galvanized steel.
- C. Gage and Shape: Match connecting ductwork.

## 2.5 FLEXIBLE CONNECTORS

- A. Materials: Flame-retardant or noncombustible fabrics.
- B. Coatings and Adhesives: Comply with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install volume dampers at points on supply and return systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
  1. Install steel volume dampers in steel ducts.
  2. Install aluminum volume dampers in aluminum ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install fire dampers according to UL listing.
- G. Install flexible connectors to connect ducts to equipment.
- H. Connect terminal units to supply ducts with maximum 6-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- I. Connect flexible ducts to metal ducts with [adhesive plus sheet metal screws.
- J. Install duct test holes where required for testing and balancing purposes.
- K. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

### 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  1. Operate dampers to verify full range of movement.
  2. Inspect locations of access doors and verify that purpose of access door can be performed.
  3. Operate fire dampers to verify full range of movement and verify that proper heat-response device is installed.

4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300





## SECTION 233416 – CENTRIFUGAL HVAC FANS

### 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. Exhaust Fans.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan performance ratings on sea level.
- B. Operating Limits: Classify according to AMCA 99.

#### 1.4 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound-power ratings.
  - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 4. Material thickness and finishes, including color charts.
  - 5. Dampers, including housings, linkages, and operators.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For centrifugal fans to include in emergency, operation, and maintenance manuals.

## 1.5 QUALITY ASSURANCE

- A. AMCA compliance is an optional requirement and not necessarily available from all manufacturers.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA 1.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

## 1.7 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

# PART 2 - PRODUCTS

## 2.1 CENTRIFUGAL FANS

- 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on the drawings or approved equal:
  - 1. Greenheck
  - 2. Loren Cook
  - 3. Or Approved Equal
- D. Exhaust Fans – Model SBE:
  - 1. Model SBE wall mounted propeller fan shall be belt drive type. The fan housing and shroud shall be constructed of heavy gauge aluminum with a rigid internal support structure. The fan shroud shall have a rolled bead for added strength.

2. Galvanized steel construction - Heavy gauge mounting flanges - Pre-punched mounting holes – Inside flanges allow damper to be mounted - Overlapping weatherhood flange keeps rain out - OSHA Protective guard of welded steel wire completely protects the drive side of the wall housing.
3. Motors shall be mounted out of the airstream on vibration isolators. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants. Motors shall be readily accessible for maintenance.
4. A disconnect switch shall be factory installed and wired from the motor compartment for ease of electrical wiring. Galvanized rigid wire protects the fan's discharge from birds or small objects.
5. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.
6. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.
7. Enclosure constructed for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment and to provide a degree of protection against falling dust. This enclosure meets the rod entry and the indoor corrosion protection design tests. The rod entry test is intended to simulate incidental contact with enclosure equipment. Enclosure is equipped with provision to lockout in the off position with customer supplied lock..

## 2.2 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install centrifugal fans level and plumb.
- B. Support suspended units from structure using threaded steel rods and vibration isolators.
- C. Install units with clearances for service and maintenance.

### 3.2 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  3. Verify that cleaning and adjusting are complete.
  4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  5. Adjust belt tension.
  6. Adjust damper linkages for proper damper operation.
  7. Verify lubrication for bearings and other moving parts.
  8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  9. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
  10. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 233416

## SECTION 233713 – DIFFUSERS, REGISTERS, AND GRILLES

### 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 ceiling- and wall-mounted diffusers, registers, and grilles.
- B. Related Sections include the following:
  - 1. Division 23 Section "Duct Accessories" for fire dampers and volume-control dampers not integral to diffusers, registers, and grilles.

#### 1.3 SUBMITTALS

- A. Product Data: For each product indicated, include the following:
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Coordination Drawings ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Ceiling suspension assembly members.
  - 2. Method of attaching hangers to building structure.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  - 5. Duct access panels.
- C. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.
- D. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

### 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. Products: Subject to compliance with requirements, provide one of the products specified.
3. 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.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 DIFFUSERS AND REGISTERS

- A. Manufacturers:
  1. Titus
  2. Anemostat; a Mestek Company
  3. Carnes
  4. Approved Equal
- B. Refer to drawings for types of diffusers, registers and grilles in this project. Model #'s and Mfr's names have been provided on the drawings.

## 2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

### 3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713





## SECTION 238126 – SPLIT-SYSTEM AIR-CONDITIONERS

### 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 split-DX heat pump and air conditioning units.

#### 1.3 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.
- F. Warranty: Special warranty specified in this Section.

#### 1.4 QUALITY ASSURANCE

- A. 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.
- B. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- C. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

#### 1.5 COORDINATION

- A. Coordinate size and location of concrete bases for units. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."

## 1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set of filters for each unit.

## 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:

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Daikin Applied
2. Mitsubishi
3. Fujitsu
4. LG HVAC
5. Or Approved Equal.

### 2.2 UNITS

- A. System Description: The Air Conditioner system shall be a Trane split system with Variable Speed Inverter Compressor technology. The system shall consist of a horizontal discharge, single phase outdoor unit, matched capacity indoor cassette units that shall be equipped with a wired wall mounted, wireless wall mounted remote controller. Refer the drawings and mechanical schedules for types of models of units.

- B. Quality Assurance:

1. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.
2. All wiring shall be in accordance with the National Electrical Code (N.E.C.) and local codes as required.
3. The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 210 and bear the ARI Certification label.
4. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
5. A dry air holding charge shall be provided in the indoor section.
6. The outdoor unit shall be pre-charged with R-410a refrigerant for 70 feet (20 meters) of refrigerant tubing.
7. System efficiency shall meet or exceed SEER values as scheduled on the plans.

C. Delivery, Storage and Handling:

1. Unit shall be stored and handled according to the manufacturer's recommendations.
2. The controller shall be shipped separately and shall be able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

D. Warranty:

1. The units shall have a manufacturer's parts and defects warranty for a period five (5) year from date of installation. The compressor shall have a warranty of seven (7) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.
2. Manufacturer shall have over thirty (30) years of continuous experience in the U.S. market.

E. Outdoor Unit Design:

1. The outdoor unit shall be equipped with an electronic control board that interfaces with the indoor unit to perform all necessary operation functions.
2. The outdoor unit shall be capable of cooling operation down to 0°F (-18°C) ambient temperature without additional low ambient controls (optional wind baffle shall be required).
3. The outdoor unit shall be able to operate with a maximum height difference of 100 feet between indoor and outdoor units.
4. System shall operate at up to a maximum refrigerant tubing length of 165 feet (50 meters) for the 36,000 units between indoor and outdoor units without the need for line size changes, traps or additional oil.
5. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory.
6. Outdoor unit sound level shall not exceed 48dB (A).

F. Cabinet:

1. The casing shall be constructed from galvanized steel plate, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection.
2. Mounting feet shall be provided and shall be welded to the base of the cabinet and be of sufficient size to afford reliable equipment mount and stability.
3. Easy access shall be afforded to all serviceable parts by means of removable panel sections.
4. The fan grill shall be of ABS plastic.

5. Cabinet mounting and construction shall be sufficient to withstand 155 MPH wind speed conditions for use in Hurricane condition areas. Mounting, base support, and other installation to meet Hurricane Code Conditions shall be by others.

G. Fan:

1. Each unit shall be furnished with a single DC fan motor.
2. The fan blade(s) shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated.
3. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent external contact with moving parts.

H. Coil:

1. The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up and allow maximum airflow. The coil shall be protected with an integral metal guard.
2. Refrigerant flow from the condenser shall be controlled by means of an electronic linear expansion valve (LEV) metering device. The LEV shall be controlled by a microprocessor controlled step motor.
3. All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.27 BTU-inch/hour per Sq Ft / °F, a water vapor transmission equal to or better than 0.08 Perm-inch and superior fire ratings such that insulation will not contribute significantly to fire and up to 1" thick insulation shall have a - Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102.

I. Compressor:

1. The compressor shall be a DC twin-rotor rotary compressor with Variable Speed Inverter Drive Technology.
2. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which shall result in significant energy savings.
3. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant. No crankcase heater is to be used.
4. The outdoor unit shall have an accumulator and high pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.

J. Electrical:

1. The electrical power of the unit shall be 208volts, single phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 187 volts to 253 volts.
2. Power for the indoor unit shall be supplied from the outdoor unit via Mitsubishi Electric A-Control using three (3) fourteen (14) gauge AWG conductors plus ground wire connecting the units.
3. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC.
4. The unit shall have Pulse Amplitude Modulation circuit to utilize 98% of input power supply.

K. Operating Range:

1. The Cooling Operating Temperature Range shall be 0°F to 118°F.
2. The Heating Operating Temperature Range shall be -4°F to 78°F.

L. Unit Cabinet:

1. The cabinet shall be formed from high strength molded plastic with smooth finish, flat front panel design with access for filter. Cabinet color shall be white.

M. Fan:

1. The indoor unit fan shall be high performance, double inlet, forward curve, direct drive sirocco fan with a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall consist of three (3) speeds: Low, Mid, and Hi and Auto. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.

O. Vane:

1. There shall be a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall significantly decrease downward air resistance for lower sound levels, and shall close the outlet port when operation is stopped. There shall also be a set of vertical vanes to provide horizontal swing airflow movement.

P. Filter:

1. Return air shall be filtered by means of an easily removable washable filter.

Q. Coil:

1. The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All tube joints shall be brazed with PhosCopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil. An optional drain pan level switch (DPLS1), designed to connect to the control board, shall be provided if required, and installed on the condensate pan to prevent condensate from overflowing.

R. Electrical:

1. The electrical power of the unit shall be 208 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 187 volts to 253 volts. The power to the indoor unit shall be supplied from the outdoor unit, using the Mitsubishi Electric A-Control system. For A-Control, a three (3) conductor AWG-14 wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units.

S. Performance:

1. Each system shall perform in accordance to the ratings shown in the manufacturer catalog. Cooling performance shall be based on 80°F DB, 67°F WB (26.7°C DB, 19.4°C WB) for the indoor unit and 95°F DB, 75°F WB (35°C DB, 29.3°C WB) for the outdoor unit.

T. System Control:

1. The control system shall consist of a minimum of two (2) microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from a wireless or wired controller, providing emergency operation and controlling the outdoor unit. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. Indoor units shall have the ability to control supplemental heat via connector CN152 and a 12 VDC output.

U. System Control: The indoor unit control board shall have auxiliary control contact connectors.

V. Remote Controllers: All remote controllers need to be ordered separately from the unit. Provide remote controllers as called out on the drawings and mechanical schedules.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install in-door units using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install roof-mounting outdoor units on equipment supports. Anchor units to supports with removable, cadmium-plated fasteners.
- D. Install seismic restraints.
- E. Install outdoor units on restrained, spring isolators with a minimum static deflection of 1 inch.
- F. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to unit to allow service and maintenance.

### 3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.

### 3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Refer to Division 1 Section "Closeout Procedures / Demonstration and Training."

END OF SECTION 238126





## SECTION 238236 - FINNED-TUBE RADIATION HEATERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes electric baseboard radiation heaters.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include details and dimensions of custom-fabricated enclosures.
  - 4. Indicate location and size of each field connection.
  - 5. Indicate location and arrangement of piping valves and specialties.
  - 6. Indicate location and arrangement of integral controls.
  - 7. Include enclosure joints, corner pieces, access doors, and other accessories.
  - 8. Include diagrams for power, signal, and control wiring.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Color Samples for Initial Selection: For finned-tube radiation heaters with factory-applied color finishes.
- E. Color Samples for Verification: For each type of exposed finish.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Structural members, including wall construction, to which finned-tube radiation heaters will be attached.
  - 2. Method of attaching finned-tube radiation heaters to building structure.
  - 3. Penetrations of fire-rated wall and floor assemblies.

- B. Field quality-control reports.

## PART 2 - PRODUCTS

### 2.1 ELECTRIC BASEBOARD RADIATION HEATERS

- A. APPROVED MANUFACTURERS

- 1. QMark (BOD)
- 2. Trane
- 3. Or Approved Equal

- B. Description: Factory-packaged units constructed according to UL 499, UL 1030, and UL 2021.

- 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. Heating Elements: Nickel-chromium-wire heating element enclosed in metallic sheath mechanically bonded to fins, with high-temperature cutout and sensor running the full length of the element. Element supports shall eliminate thermal expansion noise.

- 1. Volts: **Refer to drawings and mechanical schedule.**
- 2. Phase: **Refer to drawings and mechanical schedule.**
- 3. Hertz: **Refer to drawings and mechanical schedule.**
- 4. Heat Output: **Refer to drawings and mechanical schedule.**

- D. Enclosures: **Refer to drawings and mechanical schedule.**

- 1. Full-height back.
- 2. Full-length damper.
- 3. End panel.
- 4. End caps.
- 5. Inside and outside corners.
- 6. Joiner pieces to snap together.
- 7. Enclosure Height: **Refer to drawings and mechanical schedule.**
- 8. Enclosure Depth: **Refer to drawings and mechanical schedule.**
- 9. Finish: Baked-enamel finish in manufacturer's color as selected by Architect.
- 10. Element Brackets: Primed and painted steel to support front panel and element.

- E. Rust-Resistant Enclosures: **Refer to drawings and mechanical schedule.**

- 1. Full-height back.
- 2. Full-length damper.
- 3. End panel.
- 4. End caps.
- 5. Inside and outside corners.
- 6. Joiner pieces to snap together.
- 7. Enclosure Height: **Refer to drawings and mechanical schedule.**
- 8. Enclosure Depth: **Refer to drawings and mechanical schedule.**
- 9. Finish: Baked-enamel finish in manufacturer's color as selected by Architect.
- 10. Element Brackets: Primed and painted steel to support front panel and element.

- F. Unit Controls: **Refer to drawings and mechanical schedule.**

G. Accessories:

1. Filler sections without a heating element matching the adjacent enclosure.
2. Straight-blade-type receptacles complying with DSCC W-C-596G/GEN, NEMA WD 1, NEMA WD 6, and UL 498; in color selected by Architect.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive finned-tube radiation heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical connections to verify actual locations before installation of finned-tube radiation heaters.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 BASEBOARD RADIATION HEATER INSTALLATION

- A. Install units level and plumb.
- B. Install enclosure continuously around corners, using outside and inside corner fittings.
- C. Join sections with splice plates and filler pieces to provide continuous enclosure.
- D. Install access doors for access to valves.
- E. Install enclosure continuously from wall to wall.
- F. Terminate enclosures with manufacturer's end caps except where enclosures are indicated to extend to adjoining walls.
- G. Install valves within reach of access door provided in enclosure.
- H. Install air-seal gasket between wall and recessed flanges or front cover of fully recessed unit.
- I. Install piping within pedestals for freestanding units.

### 3.3 CONNECTIONS

- A. Install piping adjacent to finned-tube radiation heaters to allow service and maintenance.
- B. Ground electric finned-tube radiation heaters according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Units will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 238236

## SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL

### 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. Electrical equipment coordination and installation.
  - 2. Sleeves for raceways and cables.
  - 3. Sleeve seals.
  - 4. Grout.
  - 5. Common electrical installation requirements.

#### 1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For sleeve seals.

#### 1.5 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate with asbestos abatement plans and specifications and with abatement contractor for all work that potentially will disturb asbestos.

## 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 Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to manufacturers specified or approved equal.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified or approved equal.

### 2.2 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
  - 1. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

### 2.3 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  - 1. Manufacturers: Subject to compliance with requirements.
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
    - e. Or approved equal.
  - 3. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 4. Pressure Plates: Plastic. Include two for each sealing element.
  - 5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

## PART 3 - EXECUTION

### 3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

### 3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
  - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- L. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

### 3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 260500



## SECTION 260519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

### 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. This Section includes the following:
  - 1. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Sections include the following:
  - 1. Division 27 Section "Communications Horizontal Cabling" for cabling used for voice and data circuits.

#### 1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

#### 1.5 PRODUCT DELIVERY

- A. Mark and tag insulated conductors and cables for delivery to site. Include the following:
  - 1. Contractor's name.
  - 2. Project title and number.
  - 3. Date of manufacture (month & year).
  - 4. Manufacturer's name.
  - 5. Data which explains the meaning of coded identification (UL assigned electrical reference numbers, UL assigned combination of color marker threads, etc.).
  - 6. Environmental suitability information (listed or marked "sunlight resistant" where exposed to direct rays of sun; wet locations listed/marked for use in wet locations; other applications listed/marked suitable for the applications).

## 1.6 QUALITY ASSURANCE

- A. 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.
- B. Comply with NFPA 70.

## 1.7 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

## PART 2 - PRODUCTS

### 2.1 In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

- A. 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.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 CONDUCTORS AND CABLES

- A. Manufacturers
  - 1. Alcan Products Corporation; Alcan Cable Division.
  - 2. American Insulated Wire Corp.; a Leviton Company.
  - 3. General Cable Corporation.
  - 4. Pirelli Cable Corp
  - 5. Senator Wire & Cable Company.
  - 6. Southwire Company.
  - 7. Or Approved Equal.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW, USE and SO.
- D. Multiconductor Cable: Comply with NEMA WC 70 for armored cable, Type AC; metal-clad cable, Type MC; mineral-insulated, metal-sheathed cable, Type MI; Type SO and Type USE with ground wire.
- E. Electric Light and Power Wiring:
  - a. General: Rated 600V, NFPA 70 Type THHN/THWN-2 or XHHW-2.

- b. THHN/THWN-2 Gasoline and Oil Resistant: Polyvinylchloride insulation rated 600 V with nylon jacket conforming to UL requirements for type THHN/THWN-2 insulation, with the words "GASOLINE AND OIL RESISTANT II" marked thereon.
- c. USE-2: Dual rated heat and moisture resistant insulation rated 600 V with jacket or dual-purpose insulation/protective covering conforming to UL requirements for type USE-2 service entrance cables.
- d. Metal-Clad Cable, NFPA 70 Article 330 Type MC:
  - 1) Interlocked flexible galvanized steel armor sheath, conforming to UL requirements for type MC metal clad cable.
  - 2) Insulated copper conductors, suitable for 600 volts, rated 90°C, one of the types listed in NFPA 70 Table 310.13(A) or of a type identified for use in Type MC cable.
  - 3) Internal full-size copper ground conductor with green insulation.
  - 4) Acceptable Companies: AFC Cable Systems Inc., Southwire, General Cable.
  - 5) Connectors for MC cable: AFC Fitting Inc.'s AFC Series, Arlington Industries Inc.'s Saddle grip, or Thomas & Betts Co.'s Tite-Bite with anti-short bushings.

## 2.3 CONNECTORS AND SPLICES

- A. Manufacturers:
  - 1. AFC Cable Systems, Inc.
  - 2. Hubbell Power Systems, Inc.
  - 3. Illsco Corp
  - 4. O-Z/Gedney; EGS Electrical Group LLC.
  - 5. Penn Union
  - 6. 3M; Electrical Products Division.
  - 7. Tyco Electronics Corp.
  - 8. Thomas & Betts
  - 9. Or Approved Equal.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## 2.4 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

## 2.5 SLEEVE SEALS

- A. Manufacturers:
  - 1. Advance Products & Systems, Inc.
  - 2. Calpico, Inc.
  - 3. Metraflex Co.
  - 4. Pipeline Seal and Insulator, Inc.

5. Or Approved Equal.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  2. Pressure Plates: Plastic. Include two (2) for each sealing element.
  3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.4 CONNECTORS

1. Connectors specified are part of a system. Furnish connectors and components, and use specific tools and methods as recommended by connector manufacturer to form complete connector system.
2. Connectors shall be UL 486 A listed, or UL 486 B listed for combination dual rated copper/aluminum connectors (marked AL7CU for 75 degrees C rated circuits and AL9CU for 90 degrees C rated circuits).
3. Spring Type:
  - a. Rated 105° C, 600V; Buchanan/Ideal Industries Inc.'s B-Cap, Electrical Products Div./3M's Scotchlok Type Y, R, G, B, O/B+, R/Y+, or B/G+, Ideal Industries Inc.'s Wing Nuts or Wire Nuts or approved equal.
  - b. Rated 150° C, 600V; Ideal Industries Inc.'s High Temperature Wire-Nut Model 73B, 59B.
4. Indent Type with Insulating Jacket:
  - a. Rated 105° C, 600V; Buchanan/Ideal Industries Inc.'s Crimp Connectors, Ideal Industries Inc.'s Crimp Connectors, Penn-Union Corp.'s Penn-Crimps, or Thomas & Betts Corp.'s STA-KON or approved equal.
5. Indent Type (Uninsulated): Anderson/Hubbell's Versa-Crimp, VERSAtile, Blackburn/T&B Corp.'s Color-Coded Compression Connectors, Electrical Products Div./3M's Scotchlok 10000, 11000 Series, Burndy's Hydent, Penn-Union Corp.'s BCU, BBCU Series, or Thomas & Betts Corp.'s Compression Connectors or approved equal.
6. Connector Blocks: NIS Industries Inc.'s Polaris System, or Thomas & Betts Corp.'s Blackburn AMT Series or approved equal.
7. Resin Splice Kits: Electrical Products Div./3M's Scotchcast Brand Kit Nos. 82A Series, 82-B1 or 90-B1, or Scotchcast Brand Resin Pressure Splicing Method or approved equal.
8. Heat Shrinkable Splices: Electrical Products Div./3M's ITCSN, Raychem Corp.'s Thermofit Type WCS, or Thomas & Betts Corp.'s SHRINK-KON Insulators or approved equal.
9. Cold Shrink Splices: Electrical Products Div./3M's 8420 Series or approved equal.
10. Single Cable (Compression Type Lugs): Copper, one or 2 hole style (to suit conditions), long barrel; Anderson/Hubbell's VERSAtile VHCL, Blackburn/T&B Corp.'s Color-Coded CTL, LCN, Burndy's Hylug YA, Electrical Products Div./3M Scotchlok 31036 or 31145 Series, Ideal Industries Inc.'s CCB or CCBL, NSI Industries Inc.'s L, LN Series, Penn-Union Corp.'s BBLU Series, or Thomas & Betts Corp.'s 54930BE or 54850BE Series or approved equal.

11. Single Cable (Mechanical Type Lugs): Copper, one or 2 hole style (to suit conditions); Blackburn/T&B Corp.'s Color-Keyed Locktite Series, Burndy's Qiklug Series, NSI Industries Inc.'s Type TL, Penn-Union Corp.'s VI-TITE Terminal Lug Series, or Thomas & Betts Corp.'s Locktite Series or approved equal.
12. Multiple Cable (Mechanical Type Lugs): Copper, configuration to suit conditions; Burndy's Qiklug Series, NSI Industries Inc.'s Type TL, Penn-Union Corp.'s VI-TITE Terminal Lug Series, or Thomas & Betts Corp.'s Color-Keyed Locktite Series or approved equal.

## 2.5 TAPES

- A. Plastic Tape: Electrical Products Div./3M's Scotch Super 33+ or Scotch 88, Plymouth Rubber Co.'s Plymouth/ Bishop Premium 85CW or approved equal.
- B. Rubber Tape: Electrical Products Div./3M's Scotch 130C, or Plymouth Rubber Co.'s Plymouth/Bishop W963 Plysafe or approved equal.
- C. Moisture Sealing Tape: Electrical Products Div./3M's Scotch 2200 or 2210, or Plymouth Rubber Co.'s Plymouth/Bishop 4000 Plyseal-V.
- D. Electrical Filler Tape: Electrical Products Div./3M's Scotchfil, or Plymouth Rubber Co.'s Plymouth/Bishop 125 Electrical Filler Tape.
- E. Arc Proofing Tapes:
  1. Arc Proofing Tape: Electrical Products Div./3M's Scotch 77, Mac Products Inc.'s AP Series, or Plymouth Rubber Co.'s Plymouth/Bishop 53 Plyarc or approved equal.
  2. Glass Cloth Tape: Electrical Products Div./3M's Scotch 27/Scotch 69, Mac Products Inc.'s TAPGLA 5066, or Plymouth Rubber Co.'s Plymouth/Bishop 77 Plyglas or approved equal.
  3. Glass-Fiber Cord: Mac Products Inc.'s MAC 0527 or approved equal.

## 2.6 TAGS

1. Phenolic: Two color laminated engraver's stock, 1/16 inch minimum thickness, machine engraved to expose inner core color (white).
2. Aluminum: Standard aluminum alloy plate stock, minimum .032 inches thick, engraved areas enamel filled or background enameled with natural aluminum engraved characters.

## 2.7 WIRE MANAGEMENT PRODUCTS

- A. Clamps and Clips, Cable Ties, Spiral Wraps, Etc: Catamount/T&B Corp., or Ideal Industries Inc. or approved equal.

# PART 3 - EXECUTION

## 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN or Type XHHW, single conductors in raceway .
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway; Armored cable, Type AC; Metal-clad cable, Type MC or Mineral-insulated, metal-sheathed cable, Type MI.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway; Armored cable, Type AC; Metal-clad cable, Type MC or Mineral-insulated, metal-sheathed cable, Type MI.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway;; Armored cable, Type AC; Metal-clad cable, Type MC or Mineral-insulated, metal-sheathed cable, Type MI.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway; Armored cable, Type AC; Metal-clad cable, Type MC or Mineral-insulated, metal-sheathed cable, Type MI.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

### 3.4 CONNECTIONS

- A. 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.

- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### 3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
    - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports: Prepare a written report to record the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

### 3.7 INSTALLATION

- A. conductors in raceways after the raceway system is completed. Exceptions: Type MC, MI, or other type specifically indicated on the drawings not to be installed in raceways.
- B. No grease, oil, or lubricant other than wire-pulling compounds specified may be used to facilitate the installation of conductors.

### 3.8 CIRCUITING

- A. Do not change, group or combine circuits other than as indicated on the drawings.

### 3.9 COMMON NEUTRAL CONDUCTOR

- A. A common neutral may be used for 2 or 3 branch circuits where the circuits are indicated on the drawings to be enclosed within the same raceway, provided each branch circuit is connected to different phase busses in the panelboard.
- B. Exceptions - The following circuits shall have a separate neutral:
  - 1. Circuits containing ground fault circuit interrupter devices.
  - 2. Circuits containing solid state dimmers.
  - 3. Circuits recommended by equipment manufacturers to have separate neutrals.

### 3.10 CONDUCTOR SIZE

- A. Conductor Size:
  - 1. For Electric Light and Power Branch Circuits: Install conductors of size shown on drawings. Where size is not indicated, the minimum size allowed is No. 12 AWG.
  - 2. For Class 1 Circuits:
    - a. No. 18 and No. 16 AWG may be used provided they supply loads that do not exceed 6 amps (No. 18 AWG), or 8 amps (No. 16 AWG).
    - b. Larger than No. 16 AWG: Use to supply loads not greater than the ampacities given in NFPA 70 Section 310.15.
  - 3. For Class 2 Circuits: Any size to suit application.
  - 4. For Class 3 Circuits: Minimum No. 18 AWG.

### 3.11 COLOR CODING

- A. Color Coding for 120/208 Volt Electric Light and Power Wiring:
  - 1. Color Code:
    - a. 2 wire circuit - black, white.
    - b. 3 wire circuit - black, red, white.
    - c. 4 wire circuit - black, red, blue, white.
  - 2. White to be used only for an insulated grounded conductor (neutral). If neutral is not required use black and red, or black, red and blue for phase to phase circuits.
    - a. "White" for Sizes No. 6 AWG or Smaller:
      - 1) Continuous white outer finish, or:
      - 2) Three continuous white stripes on other than green insulation along its continuous length.
    - b. "White" for Sizes Larger Than No. 6 AWG:
      - 1) Continuous white outer finish, or:
      - 2) Three continuous white stripes on other than green insulation along its continuous length, or:
      - 3) Distinctive white markings (color coding tape) encircling the conductor, installed on the conductor at time of its installation. Install white color coding tape at terminations, and at 1' 0" intervals in gutters, pullboxes, and manholes.
  - 3. Colors (Black, Red, Blue):
    - a. For Branch Circuits: Continuous color outer finish.
    - b. For Feeders:
      - 1) Continuous color outer finish, or:



- 2) Color coding tapes encircling the conductors, installed on the conductors at time of their installation. Install color coding tapes at terminations, and at 1' 0" intervals in gutter, pullboxes, and manholes.

B. Color Coding For 277/480 Volt Electric Light and Power Wiring:

1. Color Code:
  - a. 2 wire circuit – brown, gray.
  - b. 3 wire circuit – brown, yellow, gray.
  - c. 4 wire circuit – brown, yellow, orange, gray.
2. Gray to be used only for an insulated grounded conductor (neutral). If neutral is not required use brown and yellow, or brown, yellow and orange for phase to phase circuits.
  - a. "Gray" For Sizes No. 6 AWG or Smaller.
    - 1) Continuous gray outer finish.
  - b. "Gray" For Sizes Larger Than No. 6 AWG:
    - 1) Distinctive gray markings (color coding tape) encircling the conductor, installed on the conductor at time of its installation. Install gray color coding tape at terminations, and at 1' 0" intervals in gutters, pullboxes, and manholes.
  - c. Colors (Brown, Yellow, Orange):
  - d. For Branch Circuits: Continuous color outer finish.
  - e. For Feeders:
    - 1) Continuous color outer finish, or:
    - 2) Color coding tapes encircling the conductors, installed on the conductors at the time of their installation. Install color coding tapes at terminations, and at 1' 0" intervals in gutters, pullboxes, and manholes.

C. More Than One Nominal Voltage System Within A building: Permanently post the color coding scheme at each branch-circuit panelboard.

D. Existing Color Coding Scheme: Where an existing color coding scheme is in use, match the existing color coding if it is in accordance with the requirements of NFPA 70.

E. Color Code For Wiring Other Than Electric Light and Power: In accordance with ICEA standard S-73-532 (NEMA WC57-2004). Other coding methods may be used, as approved.

### 3.12 IDENTIFICATION

A. Identification Tags: Use tags to identify feeders and designated circuits. Install tags so that they are easily read without moving adjacent feeders or requiring removal of arc proofing tapes. Attach tags with non-ferrous wire or brass chain.

1. Interior Feeders: Identify each feeder in pullboxes and gutters. Identify by feeder number and size.
2. Exterior Feeders: Identify each feeder in manholes and in interior pullboxes and gutters. Identify by feeder number and size, and also indicate building number and panel designation from which feeder originates.
3. Street and Grounds Lighting Circuits: Identify each circuit in manholes and lighting standard bases. Identify by circuit number and size, and also indicate building number and panel designation from which circuit originates.

B. Identification Plaque: Where a building or structure is supplied by more than one service, or has any combination of feeders, branch circuits, or services passing through it, install a permanent plaque or directory at each service, feeder and branch circuit disconnect location denoting all other services,

feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.

### 3.13 WIRE MANAGEMENT

- A. Use wire management products to bundle, route, and support wiring in junction boxes, pullboxes, wireways, gutters, channels, and other locations where wiring is accessible.

### 3.14 EQUIPMENT GROUNDING CONDUCTOR

- A. Install equipment grounding conductor:
  - 1. Where specified in other Sections or indicated on the drawings.
  - 2. In conjunction with circuits recommended by equipment manufacturers to have equipment grounding conductor.
- B. Equipment grounding conductor is not intended as a current carrying conductor under normal operating circumstances.
- C. Color Coding For Equipment Grounding Conductor:
  - 1. Color Code: Green.
  - 2. "Green" For sizes No. 6 AWG or Smaller:
    - a. Continuous green outer finish, or:
    - b. Continuous green outer finish with one or more yellow stripes, or:
    - c. Bare copper (see exception below).
  - 3. "Green" For Sizes Larger Than No. 6:
    - a. Stripping the insulation or covering from the entire exposed length (see exception below).
    - b. Marking the exposed insulation or covering with green color coding tapes.
    - c. Identify at each end and at every point where the equipment grounding conductor is accessible.
  - 4. Exception For use of Bare Copper: Not allowed for use where NFPA 70 specifically requires equipment grounding conductor to be insulated, or where specified in other Sections or indicated on the drawings to be insulated.

### 3.15 ARC PROOFING

- A. Where indicated on the drawings, arc proof feeders installed in a common pullbox or manhole as follows:
  - 1. Arc proof new feeders.
  - 2. Arc proof existing feeders that are spliced to new feeders.
  - 3. Arc proof each feeder as a unit (except feeders consisting of multiple sets of conductors).
  - 4. Arc proof feeders consisting of multiple sets of conductors by arc proofing each set of conductors as a unit.
  - 5. Arc proof feeders with half-lapped layer of 55 mils thick arc proofing tape and random wrapped or laced with glass cloth tape or glass-fiber cord. For arc proofing tape less than 55 mils thick, add layers to equivalent of 55 mils thick arc proofing tape.

### 3.16 INSULATED CONDUCTOR AND CABLE SCHEDULE - TYPES AND USE

A. Electric Light and Power Circuits:

1. Type THHN/THWN-2 or XHHW-2. : Wiring in dry or damp locations (except where special type insulation is required).
2. THHN/THWN-2 or XHHW-2: Wiring in wet locations.
3. THHN/THWN-2: Wiring installed in existing raceway systems (except where special type insulation is required).
4. THHN/THWN-2 or XHHW-2: Wiring for electric discharge lighting circuits (fluorescent, HID), except where fixture listing requires wiring rated higher than 90° C.
5. THHN/THWN-2 Marked "Gasoline and Oil Resistant": Wiring to gasoline and fuel oil pumps.
6. MC:
  - a. Branch circuit wiring in wood framed construction (wood joists and wood stud partitions):
    - 1) Install conductors parallel with joists or studs and attach to the side of these timbers by galvanized straps spaced not more than 6 feet apart.
    - 2) Install conductors through holes bored in the center of the timbers when running at right angles to joists or studs.
    - 3) Do not attach the conductors to the edge of joists or studs.
  - b. Branch circuit wiring in movable metal partitions and movable gypsum partitions.
    - 1) Install conductors in accordance with partition manufacturer's recommendations.
  - c. Branch circuit wiring in metal stud partitions:
    - 1) Install conductors parallel with studs and attach to the side by galvanized straps spaced not more than 6 feet apart.
    - 2) Install conductors through holes bored in the center of the metal member when running at right angles to studs.
      - a) Conductors shall be protected by listed bushings or listed grommets covering all metal edges.

B. Emergency Feeder Circuits: Use electrical circuit protective system.

C. Class 1 Circuits: Use Class 1 wiring specified in Part 2 (except where special type insulation is required).

D. Class 2 Circuits: Use Class 2 wiring specified in Part 2 (except where special type insulation is required).

E. Class 3 Circuits: Use Class 3 wiring specified in Part 2 (except where special type insulation is required).

### 3.17 CONNECTOR SCHEDULE - TYPES AND USE

A. Temperature Rating: Use connectors that have a temperature rating, equal to, or greater than the temperature rating of the conductors to which they are connected.

B. Splices:

1. Dry Locations:

- a. For Conductors No. 8 AWG or Smaller: Use spring type pressure connectors, indent type pressure connectors with insulating jackets, or connector blocks (except where special type splices are required).
- b. For Conductors No. 6 AWG or Larger: Use connector blocks or uninsulated indent type pressure connectors. Fill indentions in uninsulated connectors with electrical filler tape and apply insulation tape to insulation equivalent of the conductor, or insulate with heat shrinkable splices or cold shrink splices.

- c. Gutter Taps in Panelboards: For uninsulated type gutter taps fill indentions with electrical filler tape and apply insulation tape to insulation equivalent of the conductor, or insulate with gutter tap cover.
  - 2. Damp Locations: As specified for dry locations, except apply moisture sealing tape over the entire insulated connection (moisture sealing tape not required if heat shrinkable splices or cold shrink splices are used).
  - 3. Wet Locations: Use uninsulated indent type pressure connectors and insulate with resin splice kits, cold shrink splices or heat shrinkable splices. Exception: Splices above ground which are totally enclosed and protected in NEMA 3R, 4, 4X enclosures may be spliced as specified for damp locations.
- C. Terminations:
- 1. For Conductors No. 10 AWG or Smaller: Use terminals for:
    - a. Connecting wiring to equipment designed for use with terminals.
  - 2. For Conductors No. 8 AWG or Larger: Use compression or mechanical type lugs for:
    - a. Connecting cables to flat bus bars.
    - b. Connecting cables to equipment designed for use with lugs.
  - 3. For Conductor Sizes Larger Than Terminal Capacity On Equipment: Reduce the larger conductor to the maximum conductor size that terminal can accommodate (reduced section not longer than one foot). Use compression or mechanical type connectors suitable for reducing connection.

END OF SECTION 260519

## SECTION 260523 – CONTROL-VOLTAGE ELECTRICAL POWER CABLES

### 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. Low-voltage control cabling.
  - 2. Control-circuit conductors.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Source quality-control reports.

#### 1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 450 or less.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### PART 2 - PRODUCTS

#### 2.1 BACKBOARDS

- A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry."

#### 2.2 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway.

- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway or power-limited cable, concealed in building finishes, complying with UL 83.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF PATHWAYS

- A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- B. Install manufactured conduit sweeps if possible.
- C. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

### 3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets and terminals.
  - 2. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, and terminals.
  - 3. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii.
  - 4. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
  - 5. Pulling Cable: Monitor cable pull tensions.
- C. Installation of Control-Circuit Conductors:
  - 1. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
- D. Open-Cable Installation:
  - 1. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
  - 2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

### 3.3 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables made obsolete by this contract.

### 3.4 CONTROL-CIRCUIT CONDUCTORS

#### A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits, No 12 AWG.

### 3.5 GROUNDING

- #### A.
- Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

### 3.6 IDENTIFICATION

- #### A.
- Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

### 3.7 FIELD QUALITY CONTROL

- #### A.
- Perform tests and inspections.

#### B. Tests and Inspections:

1. Visually inspect cable placement, cable termination, grounding and bonding, equipment, and labeling of all components.

END OF SECTION 260523





## SECTION 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### 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. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:
  - 1. Underground distribution grounding.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
  - 1. Ground rods.
  - 2. Grounding arrangements and connections for separately derived systems.
  - 3. Grounding for sensitive electronic equipment.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
  - 1. Instructions for periodic testing and inspection of grounding features at test wells grounding connections for separately derived systems based on NETA MTS.
    - a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
    - b. Include recommended testing intervals.

#### 1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.

- B. 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.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Ground Clamps (Cable to Pipe): Blackburn/T&B Corp.'s GUV, Burndy's GAR, GD, GP, GK, or OZ/Gedney Co.'s ABG, CG or approved equal.
- B. Ground Clamps (Cable to Rod): Blackburn/T&B Corp.'s GG, GGH, JAB, GUV, Burndy's GP, GX, GRC, or OZ/Gedney Co.'s ABG or approved equal.
- C. Ground Lugs: Copper, one or 2 hole style (to suit conditions), long barrel; Anderson/Hubbell's VERSAtile VHCL, Blackburn/T&B Corp.'s Color-Coded CTL, LCN, Burndy's Hylug YA, 3M Scotchlok 31036 or 31145 Series, or Thomas & Betts Corp.'s 54930BE or 54850BE Series or approved equal.
- D. Exothermic Type Weld: Erico Inc.'s Cadweld Process, or Furseweld/T&B Corp.'s Exothermic Welding System or approved equal.
- E. Compression Connectors: Amp Inc.'s Ampact Copper Grounding System, or Burndy's Hyground System or approved equal.
- F. Rod Electrodes: Copper clad (minimum .010 jacket) ground rods minimum 5/8 inches diameter by 8'-0" long.
- G. Plate Electrodes: Copper plates minimum 0.06 inches thick by 2'-0" square feet of surface area.
- H. Grounding Electrode Conductors and Bonding Conductors: Copper conductors, bare or insulated with THW, THW-2, XHHW, XHHW-2, THWN, THWN-2 or THHN insulation.
- I. Hardware: Silicon-bronze bolts, nuts, flat and lock washers etc. as manufactured by Burndy, or OZ/Gedney Co. or approved equal.

### 2.2 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
  - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
  - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

## 2.3 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

## 2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 5/8 by 96 inches minimum in diameter. Chemical-Enhanced Grounding Electrodes shall not be used.
- B. Building steel.
- C. Underground water pipe.

# PART 3 - EXECUTION

## 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
1. Bury at least 24 inches below grade.
  2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.
- D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

### 3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  1. Feeders and branch circuits.
  2. Lighting circuits.
  3. Receptacle circuits.
  4. Single-phase motor and appliance branch circuits.
  5. Three-phase motor and appliance branch circuits.
  6. Flexible raceway runs.
  7. Armored and metal-clad cable runs.
  8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
  1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
  2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

### 3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
  1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

C. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

D. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

E. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 75 feet apart.

### 3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.
  - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
  - b. Perform tests by fall-of-potential method according to IEEE 81.
3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

## SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### 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. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.
- B. Related Sections include the following:
  - 1. Division 26 Section "Vibration and Seismic Controls For Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

#### 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

#### 1.5 SUBMITTALS

- A. Product Data: For the following:

Mount Pleasant CSD/  
New Maintenance Building  
NYSED #66-08-01-06-3-012-001

260529-1

#4.1449.02

1. Steel slotted support systems.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
  1. Trapeze hangers. Include Product Data for components.
  2. Steel slotted channel systems. Include Product Data for components.
  3. Equipment supports.
- C. Welding certificates.

## 1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

## 1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

## PART 2 - PRODUCTS

### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  1. Manufacturers:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Tyco International, Ltd.
    - g. Wesanco, Inc.
    - h. Or Approved Equal.
  2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  5. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.



1. Manufacturers:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. Fabco Plastics Wholesale Limited.
    - d. Seasafe, Inc.
    - e. Or Approved Equal.
  2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
  3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
  4. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Manufacturers:
      - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti Inc.
      - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 5) MKT Fastening, LLC.
      - 6) Or Approved Equal.
  2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
  3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
  4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
  5. Toggle Bolts: All-steel springhead type.
  6. Hanger Rods: Threaded steel.

## 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports where permitted by signed and sealed shop drawings.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70 where permitted by signed and sealed shop drawings.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or Spring-tension clamps.
  - 6. To Light Steel: Sheet metal screws.

7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529



## SECTION 260532 – INTERIOR RACEWAYS, FITTINGS, AND ACCESSORIES

### PART 1 - GENERAL

#### 1.01 REFERENCES

- A. NFPA, NEMA, ANSI, and UL.

#### 1.02 SUBMITTALS

- A. Product Data: Catalog sheets, specifications and installation instructions.

### PART 2 - PRODUCTS

#### 2.01 RACEWAYS

- A. Rigid Ferrous Metal Conduit: Steel, hot dipped galvanized on the outside and inside, UL categorized as Rigid Ferrous Metal Conduit (identified on UL Listing Mark as Rigid Metal Conduit - Steel or Rigid Steel Conduit), by Allied Tube & Conduit Corp., Republic Conduit, or Wheatland Tube Co. or approved equal.
- B. Intermediate Ferrous Metal Conduit: Steel, galvanized on the outside and enameled on the inside, UL categorized as Intermediate Ferrous Metal Conduit (identified on UL Listing Mark as Intermediate Metal Conduit or IMC), by Allied Tube & Conduit Corp., Republic Conduit, or Wheatland Tube Co. or approved equal.
- C. Electrical Metallic Tubing: Steel, galvanized on the outside and enameled on the inside, UL categorized as Electrical Metallic Tubing (identified on UL Listing Mark as Electrical Metallic Tubing), by Allied Tube & Conduit Corp Republic Conduit, or Wheatland Tube Co. or approved equal.
- D. Flexible Metal Conduit: Galvanized steel strip shaped into interlocking convolutions, UL categorized as Flexible Metal Conduit (identified on UL Listing Mark as Flexible Steel Conduit or Flexible Steel Conduit Type RW), by AFC Cable Systems Inc., Anamet Electrical Inc., Electri-Flex Co., or International Metal Hose Co. or approved equal.
- E. Liquid-tight Flexible Metal Conduit: UL categorized as liquid-tight flexible metal conduit (identified on UL Listing Mark as Liquid-Tight Flexible Metal Conduit, also specifically marked with temperature and environment application data), by AFC Cable Systems Inc., Anamet Electrical Inc., Electri-Flex Co., or Universal Metal Hose Co. or approved equal.
- F. Wireways, Fittings and Accessories:
  - 1. NEMA 1 (Without Knockouts): Square D Co.'s Class 5100, Cooper B-Line, Hubbell/Wiegmann's HS Series or equivalent as manufactured by Pentair/Hoffman or approved equal.

#### 2.02 FITTINGS AND ACCESSORIES

- A. Insulated Bushings:
  - 1. Threaded, malleable iron/zinc electroplate with 105 degrees C minimum plastic insulated throat; Appleton Electric Co.'s BU50I Series, Cooper/Crouse-Hinds' 1031 Series, OZ/Gedney Co.'s IBC-50 Series, Raco Inc.'s 1132 Series, Steel City/T & B Corp.'s BI-901 Series, or Thomas & Betts Corp.'s 1222 Series or approved equal.

2. Threaded malleable iron with 150 degrees C plastic throat; Appleton Electric Co.'s BU501 Series, Cooper/Crouse-Hinds' H1031 Series, or OZ/Gedney Co.'s IBC-50 Series or approved equal.
- B. Plastic Bushings for 1/2 and 3/4 Inch Conduit:
1. 105 degrees C minimum temperature rating; Appleton Electric Co.'s BBU50, BBU75, Blackburn (T & B Corp.'s) 50 BB, 75 BB, Cooper/Crouse-Hinds' 931,932, or OZ/Gedney Co.'s IB-50, IB-75, Racco Inc.'s 1402, 1403, Steel City/T & B Corp.'s BU-501, BU-502, or Thomas & Betts Corp.'s 222, 223 or approved equal.
  2. 150 degrees C temperature rating; Appleton Electric Co.'s BBU50H, BBU75H, Cooper/Crouse-Hinds' H-931, H-932, or OZ/Gedney Co.'s A-50, A-75, or approved equal.
- C. Insulated Grounding Bushings:
1. Threaded, malleable iron/zinc electroplate with 105 degrees C minimum plastic insulated liner, and ground lug; Appleton Electric Co.'s GIB-50 Series, Cooper/Crouse-Hinds' GLL Series, OZ/Gedney Co.'s IBC-50L Series, Racco Inc.'s 1212 Series, Steel City/T & B Corp.'s BG-801 (1/2 to 2") Series, or Thomas & Betts Corp.'s 3870 or approved equal.
  2. Threaded malleable iron/zinc electroplate with 150 degrees C plastic insulated liner, and ground lug; Appleton Electric Co.'s GIB Series, Cooper/Crouse-Hinds' HGLL Series, or OZ/Gedney Co.'s IBC-50L Series, or Thomas & Betts Corp.'s 3870 or approved equal.
- D. Connectors and Couplings:
1. Locknuts: UL, steel/zinc electroplate; Appleton Electric Co.'s BL-50 Series, Cooper/Crouse-Hinds' 11 Series, OZ/Gedney Co.'s 1-50S Series, Racco Inc.'s 1002 Series, Steel City/T&B Corp.'s LN-101 Series, or Thomas & Betts Corp.'s 141 Series or approved equal.
  2. Grounding Wedge: Thomas & Betts Corp.'s 3650 Series or approved equal.
  3. Couplings for Rigid Metal and IMC Conduit: Standard galvanized threaded couplings as furnished by conduit manufacturer, Allied Tube & Conduit Corp.'s Kwik-Couple, or Thomas & Betts Corp.'s Shamrock or approved equal.
  4. Three Piece Conduit Coupling For Rigid Metal and IMC Conduit: Steel, malleable iron, zinc electroplate; Allied Tube & Conduit Corp.'s Kwik-Couple, Appleton Electric Co.'s EC-50 Series, Cooper/Crouse-Hinds' 190M Series, OZ/Gedney Co.'s 4-50 Series, Racco Inc.'s 1502 Series, Steel City/T & B Corp.'s EK-401 Series, or Thomas & Betts Corp.'s 675 Series or approved equal.
  5. Electrical Metallic Tubing Couplings and Insulated Connectors: Compression type, steel/zinc electroplate; Appleton Electric Co.'s TW-50CS1, TWC-50CS Series, Cooper/Crouse-Hinds' 1650, 660S Series, Racco Inc.'s 2912, 2922 Series, Steel City/T & B Corp.'s TC-711 Series, or Thomas & Betts Corp.'s 5120, 5123 Series or approved equal.
  6. Flexible Metal Conduit Connectors: Arlington Industries Inc.'s Saddle-Grip, OZ/Gedney Co.'s C-8T, 24-34T, ACV-50T Series, or Thomas & Betts Corp.'s Nylon Insulated Tite-Bite Series or approved equal.
  7. Liquid-tight Flexible Metal Conduit Connectors: Steel, malleable iron, zinc electroplate, insulated throat; Appleton Electric Co.'s STB Series, Cooper/Crouse-Hinds' LTB Series, OZ/Gedney Co.'s 4Q-50T Series, Racco Inc.'s 3512 Series, Steel City/T & B Corp.'s LT-701 Series, or Thomas & Betts Corp.'s 5332 Series or approved equal.
- E. Conduit Bodies (Threaded):
1. Malleable Iron/Zinc Electroplate: Zinc electroplate malleable iron or cast iron alloy bodies with zinc electroplate steel covers; Appleton Electric Co.'s Unilets, Cooper/Crouse-Hinds'

Condulets, OZ/Gedney Co.'s Conduit Bodies, or Thomas & Betts Corp.'s Conduit Bodies or approved equal.

F. Expansion Fittings:

1. Malleable Iron, Zinc Electroplate Finish: Appleton Electric Co.'s XJ or OZ/Gedney Co.'s AX (TX for EMT), with external bonding jumper or approved equal.
2. Electrogalvanized Steel: Cooper/Crouse-Hinds' XJG (XJG-EMT for EMT), or Thomas & Betts Corp.'s XJG, with internal grounding or approved equal.

G. Deflection Fittings: Appleton Electric Co.'s DF, Cooper/Crouse-Hinds' XD, or OZ/Gedney Co.'s Type DX or approved equal.

H. Sealant for Raceways Exposed to Different Temperatures: Sealing compounds and accessories to suit installation; Appleton Electric Co.'s DUC, or Kwiko Sealing Compound with fiber filler, Cooper/Crouse-Hinds' Chico A Sealing Compound with Chico X fiber, Electrical Products Division 3M Scotch products, OZ Gedney Co.'s DUX or EYC sealing compound with EYF damming fiber, or Thomas & Betts Corp.'s Blackburn DX or approved equal.

I. Vertical Conductor Supports: Kellems/Hubbell Inc.'s Conduit Riser Grips, or OZ/Gedney Co.'s Type M, Type R or approved equal.

J. Pulling-In-Line for Installation in Spare and Empty Raceways: Polypropylene monofilament utility line; Greenlee Textron Inc.'s Poly Line 430, 431, or Ideal Industries Powr-Fish Pull-Line 31-340 Series or approved equal.

## PART 3 - EXECUTION

### 3.01 RACEWAY INSTALLATION - GENERAL

A. Number of Raceways: Do not change number of raceways to less than the number indicated on the drawings.

1. Each raceway shall enclose one circuit unless otherwise indicated on the drawings.

B. Raceways for Future Use (Spare Raceways and Empty Raceways): Draw fish tape through raceways in the presence of the Director's Representative to show that the raceway is clear of obstructions.

1. Leave a pulling-in line in each spare and empty raceway.

C. Conduit Installed Concealed:

1. Install conduit concealed unless otherwise indicated on the drawings.

2. New Construction:

- a. Run conduit in the ceilings, walls, and partitions.
- b. Install conduit in concrete slabs, under slabs on grade, or under slabs above finished ceilings where indicated on the drawings. Concrete slabs that are both ceilings and floors shall be treated as floor slabs.
  - 1) Conduit in Slab: Run 3/4 inch conduit in the slab where placement of reinforcement and slab thickness is sufficient to allow 1-1/2 inches of concrete cover over conduit, otherwise run conduit under slab. Run conduit one inch and larger in the slab in the specific location(s) where it is indicated on the drawing to be run in the slab, otherwise run conduit under slab.

- a) Run conduit under reinforcement where reinforcement is in upper portion or middle of slab.
    - b) Run conduit over reinforcement where reinforcement is in lower portion of slab.
    - c) Run conduit between reinforcement where reinforcement is in upper and lower portions of slab.
    - d) Separate parallel conduits minimum of 2 inches so that each conduit will be enveloped in concrete.
    - e) Pass conduit over steel beams, if any, parallel with the reinforcement.
    - f) Tie down conduit to avoid movement during placement of concrete.
    - g) Demonstrate to the Director's Representative that conduit has been placed to allow minimum of 1-1/2 inches of concrete cover.
  - 2) Conduit Under Slab on Grade:
    - a) Run conduit under vapor barrier, if any.
    - b) Install equipment grounding conductor in each conduit. Bond at boxes and equipment to which conduit is connected.
  - 3) Conduit Under Slab, Above Finished Ceiling:
    - a) Attach conduit to bottom of slab or structure supporting the slab.
    - b) Firestop through-penetrations of the slab.
  - 3. If any portions of the conduit system cannot be installed concealed due to conditions encountered in the building, report such conditions and await approval in writing before proceeding.
- D. Conduits Penetrating Concrete Floor Slabs (Concrete slabs that are both ceilings and floors shall be treated as floor slabs):
- 1. Provide a minimum of 2 inches between conduits that vertically penetrate elevated concrete slabs.
  - 2. Provide firestopping and spray on fireproofing at locations where conduits penetrate surface of floor slab and slab is part of fire rating required for construction.
- E. Conduit Installed Exposed:
- 1. Install conduit exposed where indicated on the drawings.
  - 2. Install conduit tight to the surface of the building construction unless otherwise indicated or directed.
  - 3. Install vertical runs perpendicular to the floor.
  - 4. Install runs on the ceiling perpendicular or parallel to the walls.
  - 5. Install horizontal runs parallel to the floor.
  - 6. Do not run conduits near heating pipes.
  - 7. Installation of conduit directly on the floor will not be permitted.
- F. Conduit Size: Not smaller than 3/4 inch electrical trade size. Where type FEP, THHN, THWN, THWN-2, XHH, XHHW, or XHHW-2 conductors are specified for use under Section 260519, the minimum allowable conduit size for new Work shall be based on Type THW conductors.
- G. Conduit Bends: For 3/4 inch conduits, bends may be made with manual benders. For all conduit sizes larger than 3/4 inch, manufactured or field fabricated offsets or bends may be used. Make field fabricated offsets or bends with an approved hydraulic bender.



### 3.02 RACEWAY INSTALLATION - SPECIAL AREAS

- A. Raceways Exposed to Different Temperatures: Where portions of an interior raceway system are exposed to widely different temperatures, seal interior and exterior of raceway to prevent circulation of air from a warmer to a colder section through the raceway installation.
  - 1. Refrigerated Rooms: Install conduit body or junction box in the raceway system on warm side of refrigerated room. After conductors are installed, seal interior of the raceway at the conduit body or junction box.
  - 2. Heated Areas to Unheated Areas: After conductors are installed, seal interior of the raceway at the nearest conduit body, outlet or junction box in the heated area adjoining the unheated area.
- B. Conduit in Waterproofed Floors: Install conduit runs in waterproof floors to avoid penetrating the waterproofing. Avoid penetration of waterproofing with conduit risers so far as practicable.
  - 1. Where it is necessary to puncture the waterproofing for a conduit riser, install a standard weight steel pipe sleeve extending one inch above the finished floor level. Flash the steel pipe sleeve to the waterproofing with 16 ounce copper. Construct the flashing with a copper tube extending the full height of the sleeve, soldered to a copper base extending 6 inches in all directions from the sleeve.
  - 2. The flashing will be integrated into the waterproofing by the Construction Contractor. Provide solid cast brass floor plates with chromium finish where pipe sleeves are exposed in rooms.

### 3.03 RACEWAY SCHEDULE

- A. Rigid Ferrous Metal Conduit: Install in locations where specified or indicated on the drawings or referenced below.
  - 1. Boiler Room
  - 2. Rooftop equipment where conduit is exposed.
- B. Intermediate Ferrous Metal Conduit: May be installed in all dry and damp locations except:
  - 1. Where other type raceways are specified or indicated on the drawings.
- C. Electrical Metallic Tubing:
  - 1. May be installed concealed as branch circuit conduits above suspended ceilings where conduit does not support fixtures or other equipment.
  - 2. May be installed concealed as branch circuit conduits in hollow areas in dry locations, including:
    - a. Hollow concrete masonry units, except where cores are to be filled (use Rigid Metal Conduit).
    - b. Drywall construction with sheet metal studs, except where studs are less than 3-1/2 inches deep.
  - 3. May be installed exposed as branch circuit conduits in dry non-hazardous locations at elevations over 10'-0" above finished floor where conduit does not support fixtures or other equipment.

- D. Flexible Metal Conduit: Install equipment grounding conductor in the flexible metal conduit and bond at each box or equipment to which conduit is connected:
1. Use for final conduit connection to recessed lighting fixtures in suspended ceilings. Use 4 to 6 feet of flexible metal conduit, minimum size 1/2 inch, between junction box and fixture. Locate junction box at least 1 foot from fixture and accessible if the fixture is removed.
  2. Use 1 to 3 feet of flexible metal conduit for final conduit connection to:
    - a. Emergency lighting units.
    - b. Dry type transformers.
    - c. Motors with open, drip-proof or splash-proof housings.
    - d. Equipment subject to vibration (dry locations).
    - e. Equipment requiring flexible connection for adjustment or alignment (dry locations).
  3. May be installed concealed as branch circuit conduits in drywall construction with sheet metal studs, except where studs are less than 3-1/2 inches deep.
- E. Liquid-tight Flexible Metal Conduit: Install equipment grounding conductor in liquid-tight flexible metal conduit and bond at each box or equipment to which conduit is connected:
1. Use 1 to 3 feet of liquid-tight flexible metal conduit (UL listed and marked suitable for the installation's temperature and environmental conditions) for final conduit connection to:
    - a. Motors with weather-protected or totally enclosed housings.
    - b. Equipment subject to vibration (damp and wet locations).
    - c. Equipment requiring flexible connection for adjustment or alignment (damp and wet locations).
- F. Wireways: May be used indoors in dry locations for exposed raceway between grouped, wall mounted equipment.

### 3.04 FITTINGS AND ACCESSORIES SCHEDULE

A. General:

1. Use fittings and accessories that have a temperature rating equal to, or higher than the temperature rating of the conductors to be installed within the raceway.
2. Use zinc electroplate or hot dipped galvanized steel/malleable iron or cast iron alloy fittings and accessories in conjunction with ferrous raceways in dry and damp locations unless otherwise specified or indicated on the drawings.
3. Use insulated grounding bushings or grounding wedges on ends of conduit for terminating and bonding equipment grounding conductors, when required, if cabinet or boxes are not equipped with grounding/bonding screws or lugs.
4. Use caps or plugs to seal ends of conduits until wiring is installed to exclude foreign material.
5. Use insulated grounding bushings on the ends of conduits that are not directly connected to the enclosure, such as stub-ups under equipment, etc., and bond between bushings and enclosure with equipment grounding conductor.
6. Use expansion fittings where raceways cross expansion joints (exposed, concealed, buried).
7. Use deflection fittings where raceways cross expansion joints that move in more than one plane.
8. Use 2 locknuts and an insulated bushing on end of each conduit entering sheet metal cabinet or box in dry or damp locations.
  - a. Plastic bushing may be used on 3/4 inch conduit in lieu of insulated bushing.

- b. Terminate conduit ends within cabinet/box at the same level.
- B. For Rigid and Intermediate Metal Conduit: Use threaded fittings and accessories. Use 3 piece conduit coupling where neither piece of conduit can be rotated.
- C. For Electrical Metallic Tubing: Use compression type connectors and couplings.
- D. For Flexible Metal Conduit: Use flexible metal conduit connectors.
- E. For Liquid-tight Flexible Metal Conduit: Use liquid-tight connectors.
- F. For Wireways: Use wireway manufacturer's standard fittings and accessories.

END OF SECTION 260532



## SECTION 260533 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
  - 1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

#### 1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. NBR: Acrylonitrile-butadiene rubber.
- G. RNC: Rigid nonmetallic conduit.

#### 1.3 MATERIALS

- A. Metal Conduits and Fittings:
  - 1. GRC.
  - 2. ARC.
  - 3. PVC-coated rigid steel conduit].
  - 4. EMT.
  - 5. FMC: Zinc-coated steel.
  - 6. LFMC.
  - 7. Fittings:
    - a. Conduit fittings for hazardous (classified) locations.
    - b. EMT: Steel type. Provide compression coupling up to 1-1/4 inch and setscrew 1-1/2 inch and larger.
    - c. Expansion fittings.
    - d. PVC coated.
- B. Nonmetallic Conduit and Fittings:
  - 1. ENT.
  - 2. RNC.

3. LFNC.
  4. HDPE.
  5. Fittings: Match conduit.
- C. Metal Wireways and Auxiliary Gutters: Sheet metal with [ screw-cover type for indoor and Flanged-and-gasketed type for outdoors unless otherwise indicated.
- D. Nonmetallic Wireways and Auxiliary Gutters: PVC plastic.
- E. Surface Metal Raceways: Metal, galvanized steel, with snap-on covers.
- F. Surface Nonmetallic Raceways: Two- or three-piece, rigid PVC.
- G. Boxes, Enclosures, and Cabinets:
1. Metal Outlet and Device Boxes: Aluminum.
  2. Nonmetallic outlet and device boxes.
  3. Metal Floor Boxes: Cast metal or[Sheet metal, fully adjustable.
  4. Nonmetallic Floor Boxes: Non-adjustable, rectangular.
  5. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb.
  6. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
  7. Small sheet metal pull and junction boxes.
  8. Cast-metal access, pull, and junction boxes.
  9. Box extensions.
  10. Gangable boxes are allowed.
  11. Hinged-Cover Enclosures: Metal or Nonmetallic.
  12. Cabinets: Galvanized steel.
- H. Handholes and Boxes for Exterior Underground Wiring: Polymer concrete with polymer-concrete, Fiberglass with polymer-concrete, Fiberglass with reinforced concrete, Fiberglass with cast-iron, Fiberglass with hot-dip galvanized-steel diamond-plate or Fiberglass with fiberglass frame and cover, prototype tested for compliance with SCTE 77.
1. Configuration: Open bottom.
  2. Weatherproof cover.
  3. Cover Legend: "ELECTRIC."

#### 1.4 RACEWAY APPLICATION

- A. Outdoors:
1. Exposed: RMC or RNC, Type EPC-80-PVC.
  2. Concealed, Aboveground: RMC.
  3. Underground: RNC, Type EPC-40-PVC, Type EPC-80-PVC,.
  4. Connection to Vibrating Equipment: LFMC.
  5. Boxes and Enclosures, Aboveground: Type 3R.
- B. Indoors:
1. Exposed, Not Subject to Physical Damage: EMT
  2. Exposed, Not Subject to Severe Physical Damage: EMT.
  3. Exposed and Subject to Severe Damage: RMC.

4. Concealed: EMT.
  5. Connection to Vibrating Equipment: FMC, except LFMC in damp or wet locations.
  6. Damp or Wet Locations: RMC.
  7. Boxes and Enclosures: Type 1, except Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Threaded rigid steel conduit fittings.
  2. PVC Externally Coated, Rigid Steel Conduits: Fittings listed for use with this type of conduit.
  3. EMT: Setscrew or compression fittings.
  4. Flexible Conduit: Fittings listed for use with flexible conduit.

## 1.5 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
1. Custom enclosures and cabinets.
- C. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified."
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Source quality-control test reports.

## 1.6 QUALITY ASSURANCE

- A. 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. Comply with NFPA 70.
  2. N. J. Uniform Construction Code
  3. NECA 1

## 1.7 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

## 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 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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 METAL CONDUIT AND TUBING

- A. Manufacturers:
  - 1. AFC Cable Systems, Inc.
  - 2. Alflec Inc.
  - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
  - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 5. Electri-Flex Co.
  - 6. Manhattan/CDT/Cole-Flex.
  - 7. Maverick Tube Corporation.
  - 8. O-Z Gedney; a unit of General Signal.
  - 9. Wheatland Tube Company.
  - 10. Or Approved Equal.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
  - 1. Comply with NEMA RN 1.
  - 2. Coating Thickness: 0.040 inch, minimum.
- E. EMT: ANSI C80.3.
- F. LFMC: Flexible steel conduit with PVC jacket.
- G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.



1. Fittings for EMT: Insulated set screws ½" through 2"; compression type 2 ½" through 4"; pie cast fittings are not permitted.
  2. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.
- H. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

## 2.3 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers:
1. AFC Cable Systems, Inc.
  2. Anamet Electrical, Inc.; Anaconda Metal Hose.
  3. Arnco Corporation.
  4. CANTEX Inc.
  5. CertainTeed Corp.; Pipe & Plastics Group.
  6. Condux International, Inc.
  7. ElecSYS, Inc.
  8. Electri-Flex Co.
  9. Lamson & Sessions; Carlon Electrical Products.
  10. Manhattan/CDT/Cole-Flex.
  11. RACO; a Hubbell Company.
  12. Thomas & Betts Corporation.
  13. Or Approved Equal.
- B. RNC: NEMA TC 2, Type EPC-40-PVC unless otherwise indicated.
- C. LFNC: UL 1660.
- D. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.
- E. Fittings for LFNC: UL 514B.

## 2.4 SURFACE RACEWAYS

- A. Surface Nonmetallic Raceways: Two or three-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hubbell Incorporated; Wiring Device-Kellems Division.
    - b. Walker Systems, Inc.; Wiremold Company (The).
    - c. Wiremold Company (The); Electrical Sales Division.
    - d. Or Approved Equal.

## 2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers:
1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.

2. EGS/Appleton Electric.
  3. Erickson Electrical Equipment Company.
  4. Hoffman.
  5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
  6. O-Z/Gedney; a unit of General Signal.
  7. RACO; a Hubbell Company.
  8. Robroy Industries, Inc.; Enclosure Division.
  9. Scott Fetzer Co.; Adalet Division.
  10. Spring City Electrical Manufacturing Company.
  11. Thomas & Betts Corporation.
  12. Walker Systems, Inc.; Wiremold Company (The).
  13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
  14. Or Approved Equal.
- B. Galvanized Steel Outlet Boxes: Standard galvanized steel boxes and device covers by Appleton Electric Co., Beck Mfg./Picoma Industries, Cooper/Crouse-Hinds, Raco/Div. of Hubbell, or Steel City/T & B Corp or approved equal.
- C. Galvanized Steel Junction and Pull Boxes: Code gage, galvanized steel screw cover boxes by Delta Metal Products Inc., Hoffman Enclosures Inc., Hubbell Wiegmann, Lee Products Co., or Rittal/Electromate or approved equal.
- D. Threaded Type Boxes:
1. Outlet Boxes:
    - a. For Dry, Damp Locations: Zinc electroplate malleable iron or cast iron alloy boxes by Appleton Electric Co., Cooper/Crouse-Hinds Co., OZ/ Gedney Co., or Thomas & Betts Corp. with zinc electroplate steel covers to suit application or approved equal.
    - b. For Wet Locations: Malleable iron or cast iron alloy boxes with hot dipped galvanized or other specified corrosion resistant finish as produced by Cooper/Crouse-Hinds (hot dipped galvanized or Corro-free epoxy powder coat), OZ/Gedney Co. (hot dipped galvanized), or Thomas & Betts Corp. (hot dipped galvanized) with stainless steel cover screws, and malleable iron covers gasketed to suit application or approved equal.
  2. Adfa. Junction and Pull Boxes:
    - a. For Dry, Damp Locations: Zinc electroplate cast iron boxes by Appleton Electric Co., Cooper/Crouse-Hinds, OZ/Gedney Co., or Thomas & Betts Corp. with zinc electroplate steel or cast iron cover or approved equal.
    - b. For Wet Locations: Cast iron boxes by Cooper/Crouse-Hinds' (hot dipped galvanized or Corro-free epoxy powder coat), OZ/Gedney Co. (hot dipped galvanized), or Thomas & Betts Corp. (hot dipped galvanized) with stainless steel cover screws and cast iron cover gasketed to suit application or approved equal.
  3. Conduit Bodies, Threaded (Provided with a Volume Marking):
    - a. For Dry, Damp Location: Zinc electroplate malleable iron or cast iron alloy bodies with zinc electroplate steel covers; Appleton Electric Co.'s Unilets, Cooper/Crouse-Hinds' Condulets, OZ/Gedney Co.'s Conduit Bodies, or Thomas & Betts Corp.'s Conduit Bodies or approved equal.
    - b. For Wet Locations: Malleable iron or cast iron alloy bodies with hot dipped galvanized or other specified corrosion resistant finish; Cooper/Crouse-Hinds' Condulets (hot dipped galvanized or Corro-free epoxy power coat), OZ/Gedney Co.'s Conduit Bodies (hot dipped galvanized), or Thomas & Betts Corp.'s Conduit Bodies (hot dipped galvanized)

with stainless steel cover screws and malleable iron covers gasketed to suit application or approved equal.

- E. Specific Purpose Outlet Boxes: As fabricated by equipment manufacturers for mounting their equipment thereon.
- F. Outlet Boxes and Related Products for Fire Rated Construction:
  - 1. Parameters For Use of Listed Metallic Outlet or Switch Boxes: UL Electrical Construction Equipment Directory - Metallic Outlet Boxes (QCIT).
  - 2. Wall Opening Protective Materials: As listed in UL Fire Resistance Directory - Wall Opening Protective Materials (CLIV), or UL Electrical Construction Equipment Directory - Wall Opening Protective Materials (QCSN).
- F. Floor Power/Data Boxes (FB):
  - 1. Three gang configuration, stamped steel floor box. Box shall be 3 by 4 by 11 inches nominal and have recessed power activations and data and audio/video compartments. Knockouts shall be available in 1/2", 3/4", and 1 inch sizes.
  - 2. Provide three gang polycarbonate concrete floor flange, color as selected by Architect.
  - 3. Model Wiremold Evolution series or approved equal.
- G. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- H. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- I. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- J. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.
- K. Nonmetallic Floor Boxes: Nonadjustable, round.
- L. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- M. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum or galvanized, cast iron with gasketed cover.
- N. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Nonmetallic Enclosures: Plastic.
- O. Cabinets:
  - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.

## 2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

1. Manholes for service conduits or duct banks shall be constructed and placed in accordance with the requirements of the affected utility company. All handholes for utility service shall comply with all requirements, including Manufacturer, of the affected utility company.
- B. Description: Comply with SCTE 77.
1. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
  2. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
  3. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  4. Cover Legend: Molded lettering, as indicated for each service.
  5. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- C. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
1. Manufacturers:
    - a. AC Miller Concrete Products
    - b. Armorcast Products Company
    - c. Carson Industries LLC.
    - d. CDR Systems Corporation.
    - e. NewBasis.
    - f. Rotondo Precast.
    - g. Quazite.
    - h. Or Approved Equal.
- D. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.
1. Manufacturers:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. Christy Concrete Products.
    - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
    - e. Or Approved Equal.
- E. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete.
1. Manufacturers:
    - a. Carson Industries LLC.
    - b. Christy Concrete Products.
    - c. Nordic Fiberglass, Inc.
    - d. Or Approved Equal.

## 2.7 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

## 2.8 SLEEVE SEALS

- A. Manufacturers:
  - 1. Advance Products & Systems, Inc.
  - 2. Calpico, Inc.
  - 3. Metraflex Co.
  - 4. Pipeline Seal and Insulator, Inc.
  - 5. Or Approved Equal.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
  - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 2. Pressure Plates: Stainless steel. Include two for each sealing element.
  - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.9 SUPPORTING DEVICES

- A. Fasteners: Furnish all fasteners and hardware compatible with the materials and methods required for attachment of supporting devices.
  - 1. Slotted Type Concrete Inserts: Galvanized pressed steel plate complying with ASTM A 283; box-type welded construction with slot designed to receive steel nut and with knockout cover, hot-dipped galvanized in compliance with ASTM A 123.
  - 2. Masonry Anchorage Devices: Expansion shields complying with FS FF-S-325, as follows:
    - a. Furnish lead expansion shields for machine screws and bolts 1/4 inch and smaller; head-out embedded nut type, single unit class, Group I, Type I, Class 1.
    - b. Furnish lead expansion shields for machine screws and bolts larger than 1/4 inch in size; head-out embedded nut type, multiple unit class, Group I, Type 1, Class 2.
    - c. Furnish bolt anchor expansion shields for lag bolts, zinc alloy, long-shield anchors class, Group II, Type 1, Class 1.
    - d. Furnish bolt anchor expansion shields for bolts, closed-end bottom bearing class, Group II, Type 2, Class 1.
  - 3. Toggle Bolts: Tumble-wing type, complying with FS FF-B-588C, Type, class and style as required.

4. Nuts, Bolts, Screws, Washers:
  - a. General: Furnish zinc-coated fasteners, with galvanizing complying with ASTM A 153 for exterior use or where built into exterior walls. Furnish fasteners for the type, grade and class required for the particular installation.
  - b. Standard Nuts and Bolts: Regular hexagon head type, complying with ASTM A 307, Grade A.
  - c. Lag Bolts: Square head type, complying with FS FF-B-561C.
  - d. Machine Screws: Cadmium plated steel, complying with FS FF-S-92.
  - e. Wood Screws: Flat head carbon steel, complying with FS FF-S-111.
  - f. Plain Washers: Round, general assembly grade carbon steel, complying with FS FF-W-92.
  - g. Lock Washers: Helical spring type carbon steel, complying with FS FF-W-84.
- B. "C" Beam Clamps:
  1. For 1 inch Conduit Maximum: B-Line Systems Inc.'s BG-8-C2, BP-8-C1 Series, or Caddy Fastener Div./Erico Products Inc.'s BC-8P and BC-8PSM Series or approved equal.
  2. For 3 inch Conduit Maximum: Appleton Electric Co.'s BH-500 Series beam clamp with H50WB Series hangers, Kindorf/T&B Corp.'s 500 Series beam clamp with 6HO-B Series hanger, or OZ/Gedney Co.'s IS-500 Series beam clamp with H-OWBS Series hanger or approved equal.
  3. For 4 inch Conduit Maximum: Kindorf/T&B Corp.'s E-231 beam clamp and E-234 anchor clip and C-149 series lay-in hanger, or Unistrut Corp.'s P2676 beam clamp and P-1659A Series anchor clip with J1205 Series lay in hanger or approved equal.
  4. For Threaded Rods (100 lbs. load max.): Caddy Fastener Div./Erico Products Inc.'s BC-4A or approved equal.
  5. For Threaded Rods (200 lbs. load max.): Appleton Electric Co.'s BH-500 Series, Kindorf/T&B Corp.'s 500 Series, or OZ/Gedney Co.'s IS-500 Series or approved equal.
  6. For Threaded Rods (300 lbs. load max.): Kindorf/T&B Corp.'s E-231 beam clamp and E-234 anchor clip, or Unistrut Corp.'s P2676 beam clamp and P-1659A Series anchor clip or approved equal.
- C. Fastener Fittings for Wood and Existing Masonry: Kindorf/T&B Corp.'s E-243, E-244, E-245, E-170, or Versabar Corp.'s VX-4310, VX-2308, VX-4308, VX-4309 or approved equal.
- D. Pipe Straps: Two hole steel conduit straps; Kindorf/T&B Corp.'s C-144 or C-280 Series or approved equal.
- E. Pipe Clamps: One-hole malleable iron type clamps; Kindorf/T&B Corp.'s HS-400 Series, or OZ/Gedney Co.'s 14-50 Series or approved equal.
- F. Channel Support System and Accessories: 12 gage galvanized steel channel and accessories; B-Line System Inc.'s B-22 (1-5/8 x 1-5/8 inches), B-12 (1-5/8 x 2-7/16 inches), B-11 (1-5/8 x 3-1/4 inches), Kindorf/T&B Corp.'s B-900 (1-1/2 x 1-1/2 inches), B-901 (1-1/2 x 1-7/8 inches), B-902 (1-1/2 x 3 inches), Unistrut Corp.'s, P-3000 (1-3/8 x 1-5/8 inches), P-5500 (1-5/8 x 2-7/16 inches), P-5500 (1-5/8 x 3-1/4 inches), or Versabar Corp.'s VA-1 (1-5/8 x 1-5/8 inches), VA-3 (1-5/8 x 2-1/2 inches) or approved equal.
- G. Supporting Fasteners (Metal Stud Construction): Metal stud supports, clips and accessories as produced by Caddy/Erico Products Inc. or approved equal.

## 2.10 NAMEPLATES AND TAGS

- A. General: Precision engraved letters and numbers with uniform margins, character size minimum 3/16 inch high.
  - 1. Phenolic: Two color laminated engraver's stock, 1/16 inch minimum thickness, machine engraved to expose inner core color (white).
  - 2. Aluminum: Standard aluminum alloy plate stock, minimum .032 inches thick, engraved areas enamel filled or background enameled with natural aluminum engraved characters.
  - 3. Materials for Outdoor Applications: As recommended by nameplate manufacturer to suit environmental conditions.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
  - 1. Exposed Conduit: Rigid steel conduit or IMC.
  - 2. Concealed Conduit, Aboveground: Rigid steel conduit, IMC or EMT.
  - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R or 4.
  - 5. Non-Metallic Conduit
    - a. Schedule 40 – Where raceways are in slab in below grade levels, for raceway duct banks.
    - b. Schedule 80 – For underground raceways outside of building which are not encased in concrete.
- B. Comply with the following indoor applications, unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT.
  - 2. Exposed and Subject to Severe Physical Damage: Rigid steel conduit or IMC. Includes raceways in the following locations:
    - a. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - b. Mechanical rooms.
  - 3.
  - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  - 6. Damp or Wet Locations: Rigid steel conduit or IMC.
  - 7. Corrosive areas: PVC coated RMC.
  - 8. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway.
  - 9. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: Riser-type, optical fiber/communications cable raceway or EMT.
  - 10. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: General-use, optical fiber/communications cable raceway or EMT.

- 11. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel or nonmetallic in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
  - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

### 3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed. Install a maximum of 150 feet between pull points, and reduce this by 25 feet for each 90 degree bend. Underground conduits for site lighting may be run a maximum of 200 feet between pole lights without an additional pull point. Underground service conduits shall meet the requirements of the utility company.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated. Install exposed at surface cabinets and for motor and equipment connection in electrical and mechanical rooms. Surface mounted installations in occupied areas, where allowed on the drawings, shall be equipped with skirts to cover conduits above and below the panels or boxes. Provide one empty 3/4 inch raceway for each three spare unused poles or spaces of each flush-mounted panelboard. Terminate empty 3/4 inch conduit in junction box, which after completion, is accessible to facilitate future branch circuit extension.
- H. Locate raceways so that strength of structural members is unaffected and they do not conflict with services of other trades. Install 1-inch or larger raceways in or through structural members (beams, slabs, etc.) only when and in manner accepted by Engineer. Draw up couplings and fittings full and tight. Protect exposed threads from corrosion by coating with red lead or zinc chromate after installation.
- I. Raceways Embedded in Slabs:
  - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  - 2. Securely tie embedded raceway in place prior to embedment.



3. Raceways installed below or in floor slabs must extend minimum of 6 inches above finished slab to first connector, unless otherwise noted.
  4. Lay out work in advance to avoid excessive concentrations of raceway runs.
  5. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  6. Change from RNC, Type EPC-40-PVC to rigid steel conduit, or IMC before rising above the floor.
- J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- L. Tighten set screws of threadless fittings with appropriately sized screwdriver or nut driver as suits the screw design.
- M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- N. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
  2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
  3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
  4. All communications conduits and sleeves shall be terminated with non-metallic bushings.
- O. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- P. Refer to Division 27 Section "COMMUNICATIONS AND DATA SYSTEMS RACEWAYS" for additional requirements.
- Q. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
- R. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semi recessed lighting fixtures. For equipment subject to vibration, noise transmission, or movement; and for all motors use a maximum of 36 inches of flexible conduit. Use LFMC in damp or wet locations. Install separate ground conductor across or through all flexible connections. Comply with NFPA 70 if more restrictive.
- S. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals. Install a second isolated ground conductor to receptacles or other devices requiring an isolated ground.

- T. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces or from outside to inside above ground. Explosion proof type seals are not required for this application.
  2. Where otherwise required by NFPA 70.
- U. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    - c. Conduits routed on rooftops within 6 inches of the roof surface shall be designed for an additional 30 degrees F temperature rise.
    - d. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
    - e. Attics: 135 deg F temperature change.
  2. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- V. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
  2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

### 3.3 BOXES

- A. Recessed Boxes in Masonry Walls: Saw-cut opening for box in masonry block horizontally in center of cell and vertically with the top flush with the top of the block, and install box flush with surface of wall. Saw cuts shall not extend more than 1/8 inch beyond box dimensions. Repair any block surfaces to original condition if saw cuts exceed this dimension. Adjust mounting height of box as required to maintain all boxes in a single course to align with the same edge of the blocks. Electrical Contractor shall be responsible for ensuring all unacceptable block cuts are repaired.
- B. Recessed boxes in drywall Walls: Outlet and device boxes shall be securely and rigidly attached or supported plumb, level, and true.
- C. Outlet and device boxes shall be located so as to not be blocked by furniture, millwork other equipment, or otherwise rendered not accessible or functional. Contractor shall relocate any boxes not meeting these criteria at no cost to the project.

- D. The boxes shall be located so that the cover or device plate will not span different types of building finishes either vertically or horizontally. Mounting heights shall be adjusted to prevent covering different finish materials but shall remain within the parameters of the New Jersey Barrier Free Subcode.
- E. Boxes for switches near doors shall be located on the side opposite the hinge and close to the door trim.
- F. Covers for outlet boxes shall be of a type designed, intended and appropriate for the use and location, and have suitable corrosion protection. Device plates shall not be used as covers for exposed installations. Plates shall be installed plumb.
- G. Back to back outlets are not allowed in any wall. Boxes located on opposite side of fire rated walls shall be separated horizontally by a minimum of two feet. Where this separation is not feasible or desirable, such as for switches at doorways, provide fire stop pads behind each box to maintain fire wall rating.
- H. Set metal floor boxes level and flush with finished floor surface.
- I. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- J. Junction and pull boxes shall be used where necessary to facilitate the pulling of wire or cable.
- K. Consideration shall be given to the size and number of conductors, number of bends in the raceway, and the need for support of conductors in vertical raceways.
- L. Junction and pull boxes shall be of a type intended or suitable for the use and location.

### 3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- B. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- C. Rectangular Sleeve Minimum Metal Thickness:
  - 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
  - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.

- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- J. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- L. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

### 3.5 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.6 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

### 3.8 OUTLET, JUNCTION AND PULLBOX INSTALLATION

- A. Mounting Position of Wall Outlets For Wiring Devices: Unless otherwise indicated, install boxes so that the long axis of each wiring device will be vertical.
- B. Height of Wall Outlets: Unless otherwise indicated, locate outlet boxes with their center lines at the following elevations above finished floor:

	MOUNTING HEIGHT
Lighting Fixtures	6'-0"
Exit Lights	8'-0" where ceiling height allows a minimum of 6 inch clearance between ceiling and top of exit light. Otherwise mount exit light so that it's top is 6 inches below finished ceiling. Adjust height and clearances as required to suit installation over doors.
Switches	4'-0"

Single & Duplex Receptacles	1'-6"*
Water Cooler Receptacles	2'-0"
IP Digital Clock Data Receptacles	7'-6"
Special Purpose Receptacles	4'-0"
Manual Fire Alarm Boxes	4'-0"
Audible Notification Appliances	8'-0" where ceiling height allows a minimum of 6 inch clearance between ceiling and top of appliance. Otherwise mount appliance so that it's top is 6 inches below finished ceiling.
Visible Notification Appliances	Install outlet so that the bottom of the visible lens will be 6'-8" AFF.
Combination Audible/Visible Notification Appliances	Install outlet so that the bottom of the visual lens will be 6'-8" AFF, and the audible section will be above the visible section.
Telecommunications	2'-0"
Data	1'-6"
Data Marked H.	Install outlet so that the highest operable part of the wall mounted telephone will not be more than 4'-0" AFF.

\*In areas containing heating convectors, install outlets above convectors at height indicated on drawings.

C. Supplementary Junction and Pull Boxes: In addition to junction and pull boxes indicated on the drawings and required by NFPA 70, provide supplementary junction and pull boxes as follows:

1. When required to facilitate installation of wiring.
2. At every third 90 degree turn in conjunction with raceway sizes over 1 inch.
3. At intervals not exceeding 100 feet in conjunction with raceway sizes over 1 inch.

D. Box Schedule for Concealed Conduit System:

1. Non-Fire Rated Construction:
  - a. Depth: To suit job conditions and comply with NFPA 70 Article 370.
  - b. For Lighting Fixtures: Use galvanized steel outlet boxes designed for the purpose.
    - 1) For Fixtures Weighing 50 lbs. or Less: Box marked "FOR FIXTURE SUPPORT".
    - 2) For Fixtures More Than 50 lbs: Box listed and marked with the weight of the fixture to be supported (or support fixture independent of the box).
  - c. For Ceiling Suspended Fans:
    - 1) For Fans Weighing 35 lbs or Less: Marked "Acceptable for Fan Support."
    - 2) For Fans Weighing More Than 35 lbs, up to 70 lbs: Marked "Acceptable for Fan Support up to 70 lbs (or support fan independent of the box)."
  - d. For Junction and Pull Boxes: Use galvanized steel boxes with flush covers.
  - e. For Switches, Receptacles, Etc:
    - 1) Plaster or Cast-In-Place Concrete Walls: Use 4 inch or 4-11/16 inch galvanized steel boxes with device covers.
    - 2) Walls Other Than Plaster or Cast-In-Place Concrete: Use type of galvanized steel box which will allow wall plate to cover the opening made for the installation of the box.

2. Recessed Boxes in Fire Rated (2 hour maximum) Bearing and Nonbearing Wood or Steel Stud Walls (Gypsum Wallboard Facings):
  - a. Use listed single and double gang metallic outlet and switch boxes. The surface area of individual outlet or switch boxes shall not exceed 16 square inches.
  - b. The aggregate surface area of the boxes shall not exceed 100 square inches per 100 square feet of wall surface.
  - c. Securely fasten boxes to the studs. Verify that the opening in the wallboard facing is cut so that the clearance between the box and the wallboard does not exceed 1/8 inch.
  - d. Separate boxes located on opposite sides of walls or partitions by a minimum horizontal distance of 24 inches. This minimum separation distance may be reduced when wall opening protective materials are installed according to the requirements of their classification.
  - e. Use wall opening protective material in conjunction with boxes installed on opposite sides of walls or partitions of staggered stud construction in accordance with the classification requirements for the protective material.
3. Other Fire Rated Construction: Use materials and methods to comply with the listing requirements for the classified construction.

E. Box Schedule for Exposed Conduit System:

1. Dry and Damp Locations: Use zinc electroplate or hot dipped galvanized threaded type malleable iron or cast iron alloy outlet, junction, and pullboxes or conduit bodies provided with a volume marking in conjunction with ferrous raceways unless otherwise specified or indicated on the drawings.
  - a. Galvanized steel boxes may be used in conjunction with conduit sizes over 1 inch in non-hazardous dry and damp locations.
  - b. Galvanized steel boxes may be used in conjunction with electrical metallic tubing where it is allowed (specified) to be installed exposed as branch circuit conduits at elevations over 10'-0" above finished floor.
2. Wet Locations: Use threaded type malleable iron or cast iron alloy outlet junction, and pullboxes or conduit bodies (provided with a volume marking) with hot dipped galvanized or other specified corrosion resistant coating in conjunction with ferrous raceways unless otherwise specified or indicated on the drawings.
  - a. Use corrosion resistant boxes in conjunction with plastic coated rigid ferrous metal conduit.
3. Finishing Collar or Combination Finishing Collar/Outlet Box (Surface Mounted Equipment Used With Exposed Raceway):
  - a. Use finishing collar where surface mounted equipment is installed on an exposed raceway outlet box and the equipment base is larger than the outlet box.
  - b. Use combination finishing collar/outlet box where surface mounted equipment is not indicated to be installed on an exposed raceway outlet box, but raceway cannot be run directly into equipment body due to equipment design.

- F. Specific Purpose Outlet Boxes: Use to mount equipment when available and suitable for job conditions. Unless otherwise specified, use threaded type boxes with finish as specified for exposed conduit system, steel (painted) for surface metal raceway system and galvanized steel for recessed installations.

### 3.9 SUPPORTING DEVICE INSTALLATION

A. Attachment of Conduit System:

1. Wood Construction: Attach conduit to wood construction by means of pipe straps with wood screws or lag bolts.
2. Masonry Construction: Attach conduit to masonry construction by means of pipe straps and masonry anchorage devices.
3. Steel Beams: Attach conduit to steel beams by means of "C" beam clamps and hangers.
4. Multiple Parallel Conduit Runs: Use channel support system.
5. Conduit Above Suspended Ceiling: Do not rest conduit directly on runner bars, T-bars, etc. Support conduit from ceiling supports or from construction above suspended ceiling.

B. Metal Stud Construction: Attach raceways and boxes to metal studs by means of supporting fasteners manufactured specifically for the purpose.

1. Support and attach outlet boxes so that they cannot torque/twist. Either:
  - a. Use bar hanger assembly, or;
  - b. In addition to attachment to the stud, also provide far side box support.

C. Support of Lighting Fixtures:

1. General: Support fixtures with suitable accessories.
2. Number of Supports (LED Fixtures):
  - a. Support individual LED fixtures less than 2 feet wide at 2 points. Support continuous row fluorescent fixtures less than 2 feet wide at points equal to the number of fixtures plus one. Uniformly distribute the points of suspension over the row of fixtures.
  - b. Support individual LED fixtures 2 feet or wider at 4 corners. Support continuous row fluorescent fixtures 2 feet or wider at points equal to twice the number of fixtures plus 2. Uniformly distribute the points of suspension over the row of fixtures.

END OF SECTION 260533





## SECTION 260543 – UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Direct-buried conduit, ducts, and duct accessories.
2. Concrete-encased conduit, ducts, and duct accessories.
3. Handholes and boxes.
4. Manholes.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data: For ducts and conduits, duct-bank materials, manholes, handholes, and boxes, and their accessories.

##### B. Shop Drawings:

1. Precast or Factory-Fabricated Underground Utility Structures:
  - a. Include plans, elevations, sections, details, attachments to other work, and accessories.
  - b. Include duct entry provisions, including locations and duct sizes.
  - c. Include reinforcement and joint details, frame and cover design, and manhole frame support rings.
2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
  - a. Include dimensioned plans, sections, elevations, accessory locations, and fabrication and installation details.
  - b. Include duct entry provisions, including locations and duct sizes.

#### 1.3 DEFINITION

##### A. RNC: Rigid nonmetallic conduit.

#### 1.4 INFORMATIONAL SUBMITTALS

##### A. Duct-Bank Coordination Drawings: Show duct profiles, locations of expansion fittings, and coordination with other utilities and underground structures on Drawings signed and sealed by a qualified professional engineer.

##### B. Product Certificates: For concrete and steel used in precast concrete handholes, as required by ASTM C 858.

##### C. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:

1. Duct entry provisions, including locations and duct sizes.
2. Reinforcement details.
3. Frame and cover design and manhole frame support rings.

4. Grounding details.
  5. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
  6. Joint details.
- D. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
1. Duct entry provisions, including locations and duct sizes.
  2. Cover design.
  3. Grounding details.
  4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
- E. Qualification Data: For professional engineer and testing agency responsible for testing nonconcrete handholes and boxes.
- F. Source quality-control reports.
- G. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Comply with ANSI C2.
- C. Comply with NFPA 70.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.
- B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

#### 1.7 PROJECT CONDITIONS

- A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.
- B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

## 1.8 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by the Authority or others unless permitted by the Authority, and then only after arranging to provide temporary electrical service.
- B. Ground Water: Assume ground-water level is 36 inches below ground surface unless a higher water table is noted on Drawings.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Rigid Ferrous Metal Conduit: Steel, galvanized on the outside and inside (conduit enameled on the inside will not be accepted), UL categorized as Rigid Ferrous Metal Conduit (identified on UL Listing Mark as Rigid Metal Conduit-Steel or Rigid Steel Conduit), as manufactured by Allied Tube & Conduit Corp., LTV Steel Tubular Products Co., Triangle Wire & Cable Inc., or Wheatland Tube Co. or approved equal.
- B. Rigid Nonmetallic Conduit And Fittings (Concrete Encased): Cantex, Inc.'s Schedule 40, Carlon Electrical Products Inc.'s Plus 40, CertainTeed Corp.'s Schedule 40, Omni/Opti-Com Manufacturing Network, Inc.'s Schedule 40 or Queen City Plastic Inc.'s Schedule 40 or approved equal.
- C. Conduit Spacers and Levelers: Commercially manufactured type to suit conduit, installation and spacing requirements.
- D. Duct Seal: Appleton Electric Co.'s DUC Weatherproof Compound, Manville Corp.'s Duxseal, OZ/Gedney Co.'s DUX, or Thomas & Betts Corp.'s DX or approved equal.
- E. Drag Line: Minimum 1/8 inch polypropylene monofilament utility rope; American Synthetic Ropes' Flotorope, Greenlee Tool Co.'s 2 ply Rope 431, or Thomas Industries/Jet Line Products' Rope 232 or approved equal.
- F. Thru Wall Sealing Bushings:
  - 1. For Walls Which Have or Will Have Membrane Waterproofing:
    - a. Cast-In-Place Installations: OZ/Gedney Co.'s Type FSK thruwall seal and Type FSKA membrane clamp adapter or approved equal.
    - b. Core Drilled or Sleeved Installations: OZ/Gedney Co.'s Type CSM and Type CSMC with membrane clamp adapter or approved equal.
  - 2. For Walls Which Will Not Have Membrane Waterproofing:
    - a. Cast-In-Place Installations: OZ/Gedney Co.'s Type FSK or approved equal.
    - b. Core Drilled or Sleeved Installations: OZ/Gedney Co.'s Type CSM, or Thunderline Corp.'s Link-Seal or approved equal.
- G. End Bells:
  - 1. For Rigid Ferrous Metal Conduit: OZ/Gedney Co.'s Type TNS or approved equal.
  - 2. For Rigid Nonmetallic Conduit: Conduit manufacturer's standard end bells or approved equal.

- H. Insulated Grounding Bushings: Appleton Electric Co.'s GIB-50 Series, Crouse Hinds GLL Series, OZ/Gedney Co.'s IBC-50L Series, Racor Inc.'s 1212 Series, or Thomas & Betts Corp.'s 3870 or BG Series or approved equal.

## 2.2 GENERAL REQUIREMENTS FOR DUCTS AND RACEWAYS

- A. Comply with ANSI C2.

## 2.3 MANUFACTURERS

- A. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.4 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
- B. RNC: NEMA TC 2, Type EPC-40-PVC and] Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

## 2.5 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Underground Plastic Utilities Duct: NEMA TC 2, UL 651, ASTM F 512, Type EPC-80 and Type EPC-40, with matching fittings complying with NEMA TC 3 by same manufacturer as the duct.
- B. Duct Accessories:
  - 1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers.
  - 2. Warning Tape: Underground-line warning tape specified in Division 26.
  - 3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi red concrete and labeled "ELECTRIC."

## 2.6 PRECAST CONCRETE HANDHOLES AND BOXES

- A. Acceptable Manufacturers:
  - 1. Carder Concrete Products.
  - 2. Christy Concrete Products.
  - 3. Elmhurst-Chicago Stone Co.
  - 4. Oldcastle Precast Group.
  - 5. Riverton Concrete Products; a division of Cretex Companies, Inc.
  - 6. Utility Concrete Products, LLC.
  - 7. Utility Vault Co.
  - 8. Wausau Tile, Inc.

9. Or approved equal.
- C. Comply with ASTM C 858 for design and manufacturing processes.
- D. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and open bottom unless closed-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
  2. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  3. Cover Legend: Molded lettering, "ELECTRIC." Configuration: Units shall be designed for flush burial and have closed bottom unless otherwise indicated.
  4. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
    - a. Extension shall provide increased depth of 12 inches
    - b. Slab: Same dimensions as bottom of enclosure and arranged to provide closure.
  5. Configuration: Units shall be designed for flush burial and have integral closed bottom, unless otherwise indicated.
  6. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
  7. Windows: Precast, reinforced openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks, plus an additional 12 inches \ vertically and horizontally to accommodate alignment variations.
    - a. Windows shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
    - b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
    - c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
1. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
    - a. Type and size shall match fittings to duct or conduit to be terminated.
    - b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.
  2. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

## 2.7 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. General Requirements for Handholes and Boxes: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application".
1. Color: Gray
  2. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
  3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  5. Cover Legend: Molded lettering, "ELECTRIC" Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.
  6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
  7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
  8. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have factory-installed inserts for cable racks and pulling-in irons.
- B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
1. Manufacturers:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. CDR Systems Corporation.
    - d. NewBasis.
    - e. Quazite.
    - f. Or Approved Equal.
- C. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
1. Manufacturers:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. Christy Concrete Products.
    - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
    - e. Or Approved Equal.
- D. High-Density Plastic Boxes: Injection molded of high-density polyethylene or copolymer-polypropylene. Cover shall be plastic.
1. Manufacturers:
    - a. Carson Industries LLC.
    - b. Nordic Fiberglass, Inc.
    - c. PenCell Plastics.
    - d. Or Approved Equal.
- E. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers made of hot-dip galvanized-steel diamond plate.
1. Acceptable Manufacturers:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. Christy Concrete Products.
    - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
    - e. Or Approved Equal.

## 2.8 PRECAST MANHOLES

- A. Comply with ASTM C 858.
- B. Structural Design Loading: Comply with requirements in "Underground Enclosure Application".
- C. Windows: Precast reinforced openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
- D. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
- E. Concrete Knockout Panels: 1-1/2 to 2 inches thick, for future conduit entrance and sleeve for ground rod.
- F. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

## PART 3 - EXECUTION

### 3.1 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Cables More than 600 V: RNC, NEMA [Type EPC-80] [Type EPC-40]-PVC, in concrete-encased duct bank unless otherwise indicated.
- B. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-80, Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.
- C. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.
- D. Underground Ducts Crossing Paved Paths, Walks and Driveways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

### 3.2 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less:
  - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-10 structural load rating.
  - 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, structural load rating.
  - 3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Heavy-duty fiberglass units with polymer concrete frame and cover, SCTE 77, Tier 8] structural load rating.
  - 4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin structurally tested according to SCTE 77 with 3000-lbf vertical loading.
  - 5. Cover design load shall not exceed the design load of the handhole or box.

### 3.3 EARTHWORK

- A. Excavation and Backfill: Comply with Division 31, but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to the "Cutting and Patching" in Division 1.

### 3.4 DUCT INSTALLATION

- A. Install ducts according to NEMA TCB 2.
- B. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes, to drain in both directions.
- C. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 both horizontally and vertically, at other locations unless otherwise indicated.
- D. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- E. Installation Adjacent to High-Temperature Steam Lines: Where duct banks are installed parallel to underground steam lines, perform calculations showing the duct bank will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct bank crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.
- F. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
  - 1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
  - 2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct banks with calculated expansion of more than 3/4 inch.
  - 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- G. Duct Entrances to Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
  - 1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.



2. Grout end bells into structure walls from both sides to provide watertight entrances.
- H. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall, without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26.
- I. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- J. Pulling Cord: Install 100-lbf-test nylon cord in empty ducts.
- K. Concrete-Encased Ducts: Support ducts on duct separators.
1. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 for pipes less than 6 inches in nominal diameter.
  2. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
  3. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
  4. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than five spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
  5. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
  6. Elbows: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.
    - a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches of concrete.
    - b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
  7. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
  8. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
  9. Concrete Cover: Install a minimum of 3 inches of concrete cover at top and bottom, and a minimum of 2 inches on each side of duct bank.
  10. Pouring Concrete: Comply with requirements in "Concrete Placement" in Division 3. Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
- L. Direct-Buried Duct Banks:
1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.

2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
  3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms for pipes less than 6 inches in nominal diameter.
  4. Install backfill.
  5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal.
  6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
  7. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.
  8. Set elevation of bottom of duct bank below the frost line.
  9. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
    - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    - b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
- M. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.
- N. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

### 3.5 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

#### A. Cast-in-Place Manhole Installation:

1. Finish interior surfaces with a smooth-troweled finish.
2. Windows for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inches thick, arranged as indicated.
3. Comply with requirements in Division 3 for cast-in-place concrete, formwork, and reinforcement.

#### B. Precast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C 891 unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances.

3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevations:

1. Install handholes with bottom below frost line, below grade.
2. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
3. Where indicated, cast handhole cover frame integrally with handhole structure.

D. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

E. Manhole Access: Circular opening in manhole roof; sized to match cover size.

1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
2. Install chimney, constructed of precast concrete collars and rings, to support cast-iron frame to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for frame to chimney.

F. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Waterproofing materials and installation are specified in waterproofing Section. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

G. Coordinate "Hardware" Paragraph below with Drawings. Delete second option if nonmetallic cable racks are specified. Show locations and quantities of required hardware on Drawings.

H. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

I. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.

J. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

### 3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.

- D. Install handholes and boxes with bottom below frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- F. Field cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

### 3.7 INSTALLATION OF MANHOLES

#### A. Spacing:

- 1. Arrangement for Power and Signal Service: Separate power system conduits from signal system conduits with minimum 6 inches thick concrete wall or 12 inches of earth.
- 2. Conduit Bank: Separate individual conduits a minimum of 3 inches. Use spacers and levelers located no more than 8 feet apart.

#### B. Depth:

- 1. Existing Grade To Remain: Unless otherwise indicated or directed, install conduit more than 18 inches below existing finished grade.
- 2. Existing Grade To Be Altered: Unless otherwise indicated or directed, install conduit more than 18 inches below the existing grade where the finished grade is to be higher than the existing grade. Where the finished grade is to be lower than the existing grade, install conduit more than 18 inches below finished grade.
- 3. Under Roads and Parking Lots:
  - a. Rigid Ferrous Metal Conduit: Unless otherwise indicated or directed, install rigid ferrous metal conduit more than 24 inches below top surface of roads and parking lots.
  - b. Rigid Nonmetallic Conduit (Concrete Encased): Unless otherwise indicated or directed, install concrete encased rigid nonmetallic conduit more than 30 inches below top surface of roads and parking lots.
- 4. Crossing Obstructions: Use rigid ferrous metal conduit where top of conduit system is less than 18 inches below finished grade when crossing obstructions (heating tunnels, etc.).
- 5. In Rock:
  - a. Unless otherwise indicated on the drawings install rigid ferrous metal conduit or concrete encased rigid nonmetallic conduit at depths previously specified. Backfill with suitable material.
  - b. Where conduit is indicated to be installed at lesser depths, use rigid ferrous metal conduit. Cover conduit with minimum 2 inches of concrete. In exposed rock area fill trench with concrete to surface level of rock.

#### C. Pitch:

- 1. Pitch conduit away from buildings.
- 2. Pitch conduit toward manhole a minimum of 12 inches per 100 feet. On runs where it is impossible to maintain the grade all one way, grade from center so that conduits pitch both directions down toward manholes.

- D. Concrete Encasement for Rigid Non-Metallic Conduit Using Either of the Two Methods Indicated Below: (Concrete Encasement for Rigid Ferrous Metal Conduit is not Required):
1. Single Pour Method - as detailed on the drawings.
  2. Two Pour Method:
    - a. Lay rigid nonmetallic conduits on a continuous concrete footing not less than 3 inches thick and as wide as the encasement. Install footings straight and true both in line of run and transversely and finished with an even surface. Incorporate anchoring devices into the footing for use in tying down the conduits. Grade footings so that conduits maintain required pitch. Before installing spacers, levelers, and conduits, let concrete footings harden as required to prevent damage to the footings.
      - 1) Where conduits enter building or manhole wall, reinforce footings for 10 feet with No. 4 rods, 4 inches on center.
      - 2) Footings are not required for rigid ferrous metal conduit.
    - b. After rigid nonmetallic conduits have been laid on footing with spacers and levelers (located no more than 8 feet apart), tie conduits down to the footing, then surround the conduits by concrete not less than 2 inches thick on top and 2 inches on each side. Separate individual conduits a minimum of 3 inches so that each conduit is completely enveloped in concrete.
      - 1) Where conduits enter building or manhole walls, reinforce encasement for 10 feet with No. 4 rods, 4 inches on center.
      - 2) Encasement is not required for rigid ferrous metal conduit.
    - c. Form sides of the concrete encasement. Exception: Earth cuts will be permitted as the form where trenches are neatly excavated in stable soils.
- E. Conduits in Filled Ground: Where indicated reinforce the footing and encasement for rigid nonmetallic conduits 10 feet beyond limits of fill. Reinforcement, footing or encasement is not required for rigid ferrous metal conduit.
- F. Conduits Entering Buildings and Manholes:
1. Seal conduit entrances into manholes watertight.
  2. Seal conduit entrances into building walls watertight. Exception: Seal is not required in below grade foundation walls associated with slab on grade construction.
  3. Install end bells at conduit entrances into manholes.
  4. Install end bells at conduit entrances into buildings. Exceptions:
    - a. Install insulated grounding bushing on conduit entrance stub up associated with slab on grade construction.
    - b. Install insulated grounding bushing and 2 locknuts on conduit where conduit is terminated in cabinet, junction or pull box.
  5. Provide transition from rigid nonmetallic conduit routed underground or below building slab to rigid ferrous metal conduit within 12 inches of building entry.
- G. Cleaning Conduits: Take precautions to prevent foreign matter from entering conduits during installation. After installation clean conduits with tools designed for the purpose.
- H. Conduit for Future Use (Spare Conduit and Empty Conduit): Demonstrate to the Director's Representative that conduits installed for future use are clear of obstructions (draw mandrel 1/2 inch less in diameter than conduit). Install a drag line in each conduit.
- I. Sealing Ends of Conduits:

1. Occupied Conduits: Seal ends of conduits to be used for Work of this contract until cables are to be installed. After cable installation, seal conduits at building entrances and first manhole outside building. Seal with duct seal.
2. Conduits For Future Use: Seal the ends of spare and empty conduits at building entrances and manholes. Seal with plastic plugs or a contrasting color cement/sand mixture.

### 3.03 CONDUIT SCHEDULE - TYPES AND USE

- A. Rigid Ferrous Metal Conduit: Install in all locations unless otherwise specified or indicated on the drawings.
- B. Rigid Nonmetallic Conduit (Concrete Encased): May be installed in all locations except:
  1. Where conduit stubs up or rises through slab or finished grade.
  2. Where other type raceways are specified or indicated on the drawings.

### 3.8 GROUNDING

- A. Ground underground ducts and utility structures according to Division 26.

### 3.9 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
  1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
  2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 6-inch- long mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
  3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26.
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

### 3.10 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 260543

## SECTION 260544 – SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data: For each type of product.

### PART 2 - PRODUCTS

#### 2.1 SLEEVES

##### A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

##### B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

##### C. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
  - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches thickness shall be 0.052 inch
  - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches thickness shall be 0.138 inch

#### 2.2 SLEEVE-SEAL SYSTEMS

##### A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Carbon steel
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

## 2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

## 2.4 GROUT

- A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## 2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
  1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
  2. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
  1. Interior Penetrations of Non-Fire-Rated Walls and Floors:



- a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 7.
    - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
  - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
  - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
  - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
- 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system. Provide FSK/WSK fittings.

### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.

- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

## SECTION 260548 – SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Restraint channel bracings.
2. Restraint cables.
3. Seismic-restraint accessories.
4. Mechanical anchor bolts.
5. Adhesive anchor bolts.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data: For each type of product.

1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
  - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
  - b. Annotate to indicate application of each product submitted and compliance with requirements.

##### B. Delegated-Design Submittal: For each seismic-restraint device.

1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic forces required to select seismic restraints.
  - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
3. Seismic -Restraint Details:
  - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
  - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events
  - c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

#### 1.3 INFORMATIONAL SUBMITTALS

##### A. Welding certificates.

- B. Field quality-control reports.

#### 1.4 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval from OSHPD in addition to preapproval, showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- D. Comply with NFPA 70.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
  - 1. Site Class as Defined in the IBC: C
  - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: III
    - a. Component Importance Factor: 1.5
    - b. Component Response Modification Factor: 2.5
    - c. Component Amplification Factor: 1.0
  - 3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 0.265
  - 4. Design Spectral Response Acceleration at 1.0-Second Period: .076

#### 2.2 RESTRAINT CHANNEL BRACINGS

- A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

#### 2.3 RESTRAINT CABLES

- A. Restraint Cables: ASTM A 603 galvanize-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

## 2.4 SEISMIC-RESTRAINT ACCESSORIES

- A. Hanger-Rod Stiffener: Reinforcing steel angle clamped to hanger rod.
- B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings.
- C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.
- D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
- E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

## 2.5 MECHANICAL ANCHOR BOLTS

- A. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

## 2.6 ADHESIVE ANCHOR BOLTS

- A. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

# PART 3 - EXECUTION

## 3.1 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.
- B. Indicate on Drawings, by details, schedules, or a combination of both, the locations where hanger rods for individual raceways, bus duct, cable trays, and hanger rods for trapeze hangers require hanger-rod stiffeners.
- C. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods caused by seismic forces.
- D. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

### 3.2 SEISMIC-RESTRAINT DEVICE INSTALLATION

#### A. Equipment and Hanger Restraints:

1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch
2. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.

#### B. Install cables so they do not bend across edges of adjacent equipment or building structure.

#### C. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

#### D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

#### E. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

### 3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

#### A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

### 3.4 FIELD QUALITY CONTROL

#### A. Perform the following tests and inspections:

1. Obtain Design Consultant's approval before transmitting test loads to structure. Provide temporary load-spreading members.
2. Test at least four of each type and size of installed anchors and fasteners selected by Design Consultant.
3. Test to 90 percent of rated proof load of device.

- B. Seismic controls will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.5 ADJUSTING

- A. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 260548





## SECTION 260553 – ELECTRICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

#### 1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

#### 1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

#### 1.4 COORDINATION

- A. 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.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage and system or service type.
- C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
  - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
  - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

### 2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Colors for Raceways Carrying Circuits at 600 V and Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage and system or service type.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

### 2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
  - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
  - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
- D. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands: Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

## 2.4 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- D. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
  - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
  - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

## 2.5 FLOOR MARKING TAPE

- A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

## 2.6 UNDERGROUND-LINE WARNING TAPE

- A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE,.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

## 2.7 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. 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.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
3. Insert names and wording of warning signs or labels; e.g., arc-flash, multiple services and voltages, and others.

## 2.8 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face <Insert colors>.
2. Punched or drilled for mechanical fasteners.

3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Self-adhesive labels not acceptable. Screw labels to enclosures. Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).
- C. Self-adhesive labels not acceptable. Screw labels to enclosures. Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

## 2.9 EQUIPMENT IDENTIFICATION LABELS

- A. Self-adhesive labels not acceptable. Screw labels to enclosures. Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.
- B. Self-adhesive labels not acceptable. Screw labels to enclosures. Engraved, Laminated Acrylic or Melamine Label: with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
- C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).
- D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

## 2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.
  1. Exterior Ferrous Metal:
    - a. Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.
      - 1) Primer: Exterior ferrous-metal primer.
      - 2) Finish Coats: Exterior semigloss alkyd enamel.
  2. Exterior Zinc-Coated Metal (except Raceways):
    - a. Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.
      - 1) Primer: Exterior zinc-coated metal primer.
      - 2) Finish Coats: Exterior semigloss alkyd enamel.
  3. Interior Ferrous Metal:
    - a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
      - 1) Primer: Interior ferrous-metal primer.

- 2) Finish Coats: Interior semigloss acrylic enamel.
4. Interior Zinc-Coated Metal (except Raceways):
  - a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
    - 1) Primer: Interior zinc-coated metal primer.
    - 2) Finish Coats: Interior semigloss acrylic enamel.
  - B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.
  - C. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
    1. Minimum Width: 3/16 inch.
    2. Tensile Strength: 50 lb, minimum.
    3. Temperature Range: Minus 40 to plus 185 deg F.
    4. Color: Black, except where used for color-coding.

## 2.11 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
  1. Not less than 6 inches wide by 4 mils thick.
  2. Compounded for permanent direct-burial service.
  3. Embedded continuous metallic strip or core.
  4. Printed legend shall indicate type of underground line.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, and handholes use color-coding conductor tape, marker tape, aluminum wraparound marker labels and write-on tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- B. 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 and write-on tags. Identify each ungrounded conductor according to source and circuit number.
- C. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
- D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
  1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- F. 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.
  1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
    - a. Power transfer switches.
    - b. Controls with external control power connections.
  2. 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.
- G. Instruction Signs:
  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.
- H. 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.
  1. Labeling Instructions:
    - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
  2. Equipment to Be Labeled:
    - a. Panelboards, electrical cabinets, and enclosures.
    - b. Access doors and panels for concealed electrical items.
    - c. Electrical switchboards.
    - d. Transformers.
    - e. Disconnect switches.
    - f. Enclosed circuit breakers.
    - g. Motor starters.
    - h. Push-button stations.
    - i. Contactors.

- j. Remote-controlled switches, dimmer modules, and control devices.
- k. Voice and data cable terminal equipment.
- l. Program equipment.
- m. Television/audio components, racks, and controls.
- n. Fire Alarm Control Panel and Remote Annunciator(s).
- o. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
- p. Monitoring and control equipment.
- q. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

### 3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-adhesive labels not acceptable. Screw labels to enclosures: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. 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.
  - 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  - 3. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
  - 4. 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.
- G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.



- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
- J. Painted Identification: Comply with requirements in Division 9 for surface preparation and paint application.

### 3.3 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 30-foot (10-m) maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
  - 1. Emergency Power – Red Labels with White Letters
  - 2. Power – Black Labels with White Letters
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
  - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
    - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
    - b. Colors for 208/120-V Circuits:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
    - c. Colors for 480/277-V Circuits:
      - 1) Phase A: Brown.
      - 2) Phase B: Orange.
      - 3) Phase C: Yellow.
    - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) 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.
- D. Install instructional sign including color-code for grounded and ungrounded conductors. Self-adhesive labels not acceptable. Screw labels to enclosures, engraved, laminated acrylic or melamine label Engraved, laminated acrylic or melamine label
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
1. Limit use of underground-line warning tape to direct-buried cables.
  2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels not acceptable. Screw labels to enclosures, engraved, laminated acrylic or melamine label Engraved, laminated acrylic or melamine label

1. Comply with 29 CFR 1910.145.
  2. Identify system voltage with black letters on an orange background.
  3. Apply to exterior of door, cover, or other access.
  4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
    - a. Power transfer switches.
    - b. Controls with external control power connections.
- I. Operating Instruction Signs: 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.
- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.
- K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the 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. Self-adhesive labels not acceptable. Screw labels to enclosures, engraved, laminated acrylic or melamine label Engraved, laminated acrylic or melamine label.
1. Labeling Instructions:
    - a. Indoor Equipment: Self-adhesive labels not acceptable. Screw labels to enclosures, engraved, laminated acrylic or melamine label Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

- b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
- c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
- d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 260553



## SECTION 260563 – EQUIPMENT CONNECTIONS AND COORDINATION

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Provide final connections to equipment and coordinate same in accordance with the Contract Documents.

#### 1.2 WORK INCLUDED

- A. Equipment to receive final connections shall include but not be limited to the following:

- 1. Lifts.
- 2. Motorized Equipment.
- 3. Appliances.
- 4. Owner Furnished Equipment.
- 5. Refrigeration Machines.
- 6. Kitchen Equipment.

- B. SUBMITTALS

- 1. None required.

- C. QUALITY ASSURANCE

- 1. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following or approved equal:
    - a. American National Standard Safety Code for Elevators Dumbwaiters and Moving Walks (ANSI A17.1).
    - b. Food and Drug Administration.
    - c. NFPA-96.

### PART 2 - PRODUCTS

- 2.1 Only those products listed in Division 26 shall be employed.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION OF DOCUMENTS

- A. Prior to the submitting of bids, this Contractor shall familiarize himself with all conditions affecting the proposed installation of equipment requiring electrical connections and shall make provisions as to the cost thereof. Failure to comply with the intent of this paragraph shall in no way relieve the Contractor of performing all necessary work required for final electrical connections and equipment and the coordination thereof.

- B. Connections shall be made in accordance with the manufacturers' recommendations and approved shop drawings.

1. ELEVATORS

- a. Connections for and coordination of elevators shall include but not be limited to the following:
- b. Dedicated power outlets one circuit per car and dedicated circuits for each cab's car lights and fans.
- c. Empty raceway from each controller to nearest telephone backboard for telephone communications.
- d. Fluorescent lighting fixture, switch and duplex outlet within each elevator pit.
- e. Empty raceways from each elevator machine room to Fire Command Center. Size and quantity of raceways as per fire alarm system vendor's requirements.
- f. Empty raceways from elevator machine room to remote elevator status panel. Size and quantity of raceways as per fire alarm system vendor's requirements.
- g. Fused disconnect switches with feeders extended to and connected at each elevator controller. Fuse sizes shall be as per elevator vendor's requirements. All fuses shall be time delay type. Switches shall be installed within sight of motors and controllers.
- h. Firefighter's telephone within elevator cab and appropriate connections at the elevator machine room and Life Safety System.

2. EQUIPMENT

- a. Connections for and coordination of motors and equipment requiring electrical connections shall include but not be limited to the following:
  - 1) Install motor controllers and disconnect switch for each motor and each piece of equipment.
  - 2) Verify that the motor rotation is correct and reconnect if necessary.
  - 3) Ground all equipment; provide separate ground wires in flexible, metal conduit and non-metallic conduit so as to provide an electrically continuous ground path.
  - 4) Provide motor branch circuit conductors and connections to each individual motor controller and from each controller to the motor through an approved disconnect switch. Make final connection in minimum 24 inch length of liquid-tight, flexible, metal conduit.
  - 5) Provide all necessary wiring and connections for interlocking, remote and automatic controls. Installation of equipment and wiring shall be in compliance with shop drawings and manufacturer's recommendations.
  - 6) Where equipment is fed from branch circuit routed in or under the slab, terminate branch circuit at J-box on 2 foot rigid conduit stub-up and make final connection to equipment in liquid-tight, flexible, metal conduit. Provide suitable knee brace on conduit stub-up.
  - 7) Where equipment is fed from overhead, support conduit feeder descending from ceiling on flanged floor fitting with conduit type fitting connecting to motor with 24-inch minimum of liquid-tight flexible steel conduit.
  - 8) Where nameplate on equipment indicates fuse protection the disconnecting means shall be equipped with time delay fuses sized as per manufacturer's recommendations.

3. APPLIANCES

- a. Connections for and coordination of appliances shall include but not be limited to the following:

- 1) The basic requirements for motors and equipment specified above shall apply where applicable.
- 2) Where cord and plugs are provided with the appliances this contractor shall coordinate the receptacle installation to match. Information on the Drawing as to receptacle type is for bidding purposes only.
- 3) Hard wired equipment shall be serviced by disconnecting means as indicated in the National Electrical Code.

#### 4. OWNER FURNISHED EQUIPMENT

- a. The requirements for equipment furnished by the owner for installation by this Contractor shall include but not be limited to the following:
  - 1) The coordination of the proper delivery scheduling of such equipment.
  - 2) The receiving and unloading of such equipment at the property line.
  - 3) The inspection of such equipment for damages, defacement, corrosion, missing components, etc. at the job site. All deficiencies shall be recorded. Deficiencies occurring after inspection shall be corrected by this contractor at his cost.
  - 4) The safe handling at secure storage of such equipment from unloading to the time of permanent installation.
  - 5) The completion of field make up of internal wiring as required.
  - 6) The lamping of equipment.
  - 7) The installation of accessories on such equipment.
  - 8) The installation of such equipment including the transportation of the equipment to the installation area, and the installation of all supports, fasteners, canopies, extensions, etc. required to insure safe support and adaptation to the finished structural, electrical and architectural conditions.
  - 9) The final connections and grounding to the building electrical system including all necessary labor and materials including but not limited to junction box extensions, lug change outs, etc.
  - 10) The testing of such equipment in its final location.

#### 5. REFRIGERATION MACHINES

- a. Connections for and coordination of refrigeration machines shall include but not be limited to the following:
  - 1) The basic requirements for motors and equipment specified above shall apply where applicable.
  - 2) Install motor controller furnished by others and provide six (6) conductors from load side of controller to lugs on machine.
  - 3) Provide 120 volt circuit to oil pump and heater if required, coordinate requirements with approved shop drawings.

#### 6. KITCHEN/LAUNDRY EQUIPMENT CONNECTIONS

- a. This Contractor is to furnish the following electrical equipment/devices and make the following connections, but is not limited to:
  - 1) All junction boxes, electrical outlets, stainless steel cover plates and switches not built into kitchen equipment.
  - 2) All plugs and cords as noted on kitchen/laundry consultant's schedules.
  - 3) Furnish and install shunt-trip branch circuit breakers or shunt-trip main circuit breakers as indicated and disconnect switches for fire control system shut-off

of kitchen equipment below hoods or ventilators as shown on the kitchen consultant's documents or the electrical documents.

- 4) Disconnect switches or other similar devices as required by code.
  - 5) Electro-magnetic overload protection for air compressors/vacuum pumps in the laundry as noted.
  - 6) Provide conduit and wiring, installation of electrical devices furnished by kitchen/laundry equipment trade and interwire between the following:
    - a) Remote refrigeration equipment to evaporative coils.
    - b) Control panels to water-type ventilators and exhaust/supply fans.
    - c) Kitchen exhaust hoods/ventilators to fire control system and shut-offs.
    - d) Signal from fire control system to local fire alarm panel with a dedicated zone per fire control system.
    - e) All outlets and connections shown on electrical kitchen/laundry drawings are indicated for kitchen/laundry equipment only. Refer to electrical drawing(s) which indicates the general areas for outlets and devices for general purpose use.
- A. The electrical kitchen/laundry plans indicate outlet type and location, and connection positions and loads. For final rough-in locations, refer to kitchen/laundry consultant's dimensioned plans. All dimensions shown are from finished floor and finished walls, unless otherwise noted.
- B. Internal electrical work for fabricated food service equipment shall be internally wired and connected by kitchen equipment manufacturer for all kitchen equipment, except as noted.
- C. All electrical work for fabricated food service equipment shall be completely wired by kitchen equipment manufacturer (except as noted above), to a junction box or pull box mounted on the equipment in an accessible position. Final connections between equipment, junction or pull boxes to the electrical panelboard (except as noted) to be the responsibility of this Contractor.
- D. This Contractor shall furnish and install size, type and quantity of beverage dispensing raceways as indicated on the electrical documents. Final connections and bending radii to be verified with kitchen consultant.

END OF SECTION 260563



## SECTION 260800 – ELECTRICAL SYSTEMS COMMISSIONING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes commissioning process requirements for electrical systems, assemblies, and equipment.

#### 1.2 DEFINITIONS

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. CxA: Commissioning Authority.
- C. Integrated Systems: When referenced this encompasses all control, equipment and systems utilized in support of the facility.
- D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

#### 1.3 CONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning tests at the direction of the CxA and as defined in the contract documents.
- B. Attend construction phase commissioning meetings.
- C. Attend test coordination meetings.
- D. Participate in the electrical system maintenance orientation and inspection for assemblies and equipment as directed by the CxA.
- E. Provide information requested by the CxA, including manufacturer cut sheets and shop drawings for final commissioning documentation.
- F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.
- G. Provide detailed startup procedures.
- H. Provide startup testing for all normal and emergency power equipment and shall coordinate and execute the electrical tasks for the commissioning checklists for all commissioned equipment.
- I. Provide copies of all submittals as required including all changes thereto.
- J. Facilitate the coordination of the commissioning and incorporate commissioning activities (the Commissioning Plan) into the Overall Project Schedule (OPS).
- K. Ensure that all subcontractors and vendors execute their commissioning responsibilities according to the contract documents.

- L. Provide training in the operation and maintenance of installed equipment for the Authority's personnel.
- M. Review and accept construction checklists provided by the commissioning authority.
- N. Complete startup reports and construction checklists as work is completed, and provide to the Commissioning Authority on a weekly basis.
- O. Review and accept commissioning process test procedures provided by the Commissioning Authority.
- P. Complete commissioning process test procedures (functional testing as detailed in functional testing checklists).
- Q. Prepare O&M manuals, according to the contract documents, including clarifying and updating the original sequences of operation to as-built/as-tested conditions.
- R. Cooperate with the CxA for resolution of issues recorded in the "Issues Log".

#### 1.4 CxA'S RESPONSIBILITIES

- A. Provide Project-specific construction checklists and commissioning process test procedures for actual electrical systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.
- B. Direct commissioning testing.
- C. Verify testing and operational sequencing per design documents.
- D. Provide a final written report outlining the commissioning process and including commissioning field documentation

#### 1.5 COMMISSIONING DOCUMENTATION

- A. The contractor shall provide the following information to the CxA for inclusion in the commissioning plan:
  - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
  - 2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
  - 3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for electrical systems, assemblies, equipment, and components to be verified and tested.
  - 4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
  - 5. System startup reports.
  - 6. Certificate of readiness certifying that electrical systems, subsystems, equipment, and associated controls are ready for testing.
  - 7. Test and inspection reports and certificates.
  - 8. Corrective action documents.
  - 9. Verification of contractually required static and dynamic testing reports.

## 1.6 SUBMITTALS

- A. Certificates of readiness.
- B. Certificates of completion of installation, prestart, and startup activities.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 TESTING PREPARATION

- A. Certify that electrical systems, subsystems, and equipment have been installed, calibrated, and started, and that they are operating in the manner required by the Contract Documents.
- B. Certify that electrical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Certify that testing and adjustments have been completed and that testing and adjustment reports have been submitted, discrepancies corrected, and corrective work approved.
- D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.
- F. Check safety cutouts, alarms, and interlocks with life-safety systems during each mode of operation.
- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as required and as directed by the CxA.

### 3.2 TESTING VERIFICATION

- A. Prior to performance of testing, provide copies of reports, sample forms, checklists, and certificates to the CxA.
- B. Notify the CxA at least (ten) 10 days in advance of testing execution, and provide access for the CxA to witness testing procedures.
- C. Provide technicians, instrumentation, and tools to verify testing of electrical systems at the direction of the CxA.
  - 1. The CxA will notify the electrical contractor ten (10) days in advance of the date of field verification. Notice will not include data points to be verified.
  - 2. The electrical contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
  - 3. Failure of an item includes, emergency power system performance as defined by the authority having jurisdiction and operational sequence as determined in the contract documents including safeties, capacity and operational integrity.

4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

### 3.3 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning tests at the direction of the CxA.
- B. Scope of electrical system testing can include, but is not limited to, entire electrical power distribution installation from central distribution to branch circuit to individual equipment served. Testing shall include measuring capacities and effectiveness of operational and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of interface to the building automation system.
- D. The CxA with coordination of a certified testing agency, shall prepare detailed testing plans, procedures, and checklists for electrical systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- G. The CxA may direct that set points be altered when simulating conditions is not practical.
- H. If tests cannot be completed because of a deficiency outside the scope of the electrical system, document the deficiency and report it to the Construction Management Representative. After deficiencies are resolved, reschedule tests.
- I. Retesting: The CxA will direct the retesting of the equipment once at no "charge" to the Authority for their time. The CxA's time and expenses incurred for a second retest, if required due to no fault of the CxA, will be reviewed by the Authority to determine the appropriate means of compensation to the CxA for extension of services. The functional testing shall include operating the system and components through each of the written sequences of operation, and other significant modes and sequences, including startup, shutdown, unoccupied mode, manual mode, staging, miscellaneous alarms, power failure, security alarm when impacted and interlocks with other systems or equipment. Sensors and actuators shall be calibrated during construction check listing by the installing contractors, and spot-checked by the CxA during functional testing.

### 3.4 ELECTRICAL SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. Electrical Installation and Verification: Testing requirements are specified in Division 26. Provide submittals, test data, inspection records to the CxA.

1. Insulation resistance testing, mechanical integrity tests and inspections, ground testing, continuity, transformer-specific tests, emergency power system and manufacturer startup according to contract, agency and authority having jurisdiction requirements as indicated in Division 26. Electrical contractor shall prepare supporting documentation for compliance for copy to the CxA.
- B. Short Circuit and Coordination Testing, Adjustment and Settings: Field testing and over-current protection coordination as specified in Division 26.
- C. NFPA 110 Chapter 7 Installation Acceptance Testing shall be conducted, including “black start” and load bank testing per Division 26. All testing shall be conducted after manufacturer startup of equipment has been completed for the Emergency Generator, Automatic Transfer Switches and all components and accessories related to the normal and emergency power infrastructure. Time and duration for the load bank test shall be in compliance with the stepped operation for the time and duration as specified in NFPA 110 and not less than two (2) hours to a maximum time as the contract designates for 100% load for the resistive or inductive load bank. Time and durations for the “black start” testing shall be determined to be not less than 1.5 hours (As specified in Div. 26) or until all systems can be verified operational as intended for representative life safety, critical and emergency standby loads. Black start testing shall include, but not be limited to, the following field verification of the following systems:
1. Emergency Generator
  2. Automatic Transfer Switches
  3. Load Banks
  4. Emergency Outlets
  5. BMS Integration (and all associated equipment served)
  6. Emergency Lighting
  7. UPS
  8. Fire alarm
  9. Security
  10. Communication Systems
  11. Branch Circuit Distribution
- D. The following equipment/systems will be commissioned in this project:
1. Emergency Power System, including but not limited to the Generator, Automatic Transfer Switches, Uninterruptable Power Supplies and all control systems.
  2. Fire Alarm System in conjunction with the Authority Having Jurisdiction
  3. Distribution Switchgear
  4. Service Switchgear and Switchboards
  5. Building Grounding System
  6. Motor Control Centers
  7. Transformers and power distribution
  8. Lighting and Lighting Controls
  9. Branch circuit distribution

END OF SECTION 260800



## SECTION 262413 – SWITCHBOARDS

### PART 1 - GENERAL

#### 1.1 REFERENCES

- A. NEMA, and UL 891.
- B. National Electrical Manufacturers Association (NEMA):
  - 1. AB-1 Molded Case Circuit Breakers.
  - 2. PB-2 - Deadfront Distribution Switchboards.
  - 3. PB2.1 - General Instructions For Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less.
- C. Underwriters Laboratories Inc.:
  - 1. UL50 - Electrical Cabinets and Boxes.
  - 2. UL67 - Electric Panelboards.
  - 3. UL489 - Molded Case Circuit Breakers and Circuit Breaker Enclosures.
  - 4. UL869 - Electrical Service Equipment.
  - 5. UL891 - Dead-Front Switchboards.
- D. Underwriters Laboratories Inc.:
  - 1. UL50 - Electrical Cabinets and Boxes.
  - 2. UL67 - Electric Panelboards.
  - 3. UL489 - Molded Case Circuit Breakers and Circuit Breaker Enclosures.
  - 4. UL869 - Electrical Service Equipment.
  - 5. UL891 - Dead-Front Switchboards.
- E. IEEE:
  - 1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial Commercial Power Systems.
  - 2. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis.
  - 3. IEEE 1584 – Guide for Performing Arc-Flash Hazard Calculations.
- F. ANSI C37.5 – Methods for Determining the RMS Value of a Sinusoidal Current Wave and Normal-Frequency Recovery Voltage, and for Simplified Calculation

#### 1.2. DEFINITIONS

- A. ITIC (Information Technology Industry Council) Curve: Describes how much or how little voltage IT equipment can sustain without damage and over what length of time.

#### 1.3 SUMMARY

- A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Transient voltage suppression devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.

## 1.2 SUBMITTALS

- A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
- B. Shop Drawings: For each switchboard and related equipment.
  1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
  2. Detail enclosure types for types other than NEMA 250, Type 1.
  3. Detail bus configuration, current, and voltage ratings.
  4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
  5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
  6. Detail utility company's metering provisions with indication of approval by utility company.
  7. Include evidence of NRTL listing for series rating of installed devices.
  8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  9. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
  10. Include schematic and wiring diagrams for power, signal, and control wiring.
- C. Product Data:
  1. Catalog sheets, specifications and installation instructions.
    - a. For devices equipped with ground fault protection, include information sheets describing system testing instructions and test form which comply with UL 891 requirements.
  2. Bill of materials.
  3. Name, address and telephone number of nearest fully equipped service organization.
- D. Quality Control Submittals:
  1. Company Field Advisor Data: Include:
    - a. Name, business address and telephone number of Company Field Advisor secured for the required services.
    - b. Certified statement from the Company listing the qualifications of the Company Field Advisor.



c. Services and each product for which authorization is given by the Company listed specifically for this project.

2. Electric Utility Company Approval:

a. Submit shop drawings and product data to the electric utility company for approval:

Central Division, Public Service Electric & Gas

b. After shop drawings and product data have been approved by the electric utility company, forward two copies with utility company letter indicating approval.

c. Metering enclosures will not be approved until electric utility company approval is received. Submit (2) – sets of shop drawings and product data to the electric utility company for approval prior to equipment order.

E. Contract Closeout Submittals:

1. System acceptance test report.

2. Certificate: Affidavit, signed by the Company Field Advisor and notarized, certifying that the system meets the contract requirements and is operating properly.

3. Operation and Maintenance Data: Deliver 2 copies, covering the installed products, to the Engineer.

F. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

G. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.

H. The short-circuit, protective device coordination and arc-flash hazard studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

I. Short Circuit Analysis/Protective Relay Coordination/Arc-Flash Hazard Analysis Study:

1. The Contractor secure the services of the Switchgear Component Manufacturer Field Advisor in order to perform a complete and thorough power study/analysis of the completed feeder circuit breakers for the purpose of determining all proper system protective relay

settings and to implement these settings. The study will continue with analysis of the connection of feeders to Switchboard via Transformers. Arc-Flash Hazard Analysis will be performed to include the branch circuit connections at Switchboard.

2. The completed study shall be submitted for review and approval by the Engineer prior to the implementation of any relay settings. This study shall be conducted under the applicable standards of the American National Standards Institute (ANSI) and the National Electrical Code (NEC) which shall include, but is not limited to:
  - a. Short-Circuit Analysis: Calculation of the maximum rms symmetrical three-phase short-circuit current at each significant location in the proposed power distribution system - beginning at the primary and secondary terminals of padmounted Transformers, Switchboard, Generator Switchboard and Branch Circuit Panelboards.
    - 1) Appropriate motor short-circuit contribution shall be included at the appropriate locations in the system so that the calculated values represent the highest short-circuit current the equipment will be subjected to under fault conditions.
    - 2) A printout shall be included which lists the calculated short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings, and notes regarding the adequacy or inadequacy of the equipment.
    - 3) The study shall include input circuit data including conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.
    - 4) Identification of the maximum available short-circuit current in rms symmetrical amperes and the X/R ratio of the fault current for each bus/branch calculation.
    - 5) The system one-line diagram shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the analysis.

- 6) A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.
- 7) The contractor shall be responsible for supplying pertinent electrical system conductor, circuit breaker, generator, and other component and system information in a timely manner to allow the short-circuit analysis to be completed prior to final installation.
- 8) Any inadequacies shall be called to the attention of the engineer and recommendations made for improvements as soon as they are identified.

b. Short-Circuit Analysis: Calculation of the maximum rms symmetrical three-phase short-circuit current at each significant location in the proposed power distribution system - beginning at the primary and secondary terminals of padmounted Transformers, Switchboard, Generator Switchboard and Branch Circuit Panelboards.

- 1) Appropriate motor short-circuit contribution shall be included at the appropriate locations in the system so that the calculated values represent the highest short-circuit current the equipment will be subjected to under fault conditions.
- 2) A printout shall be included which lists the calculated short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings, and notes regarding the adequacy or inadequacy of the equipment.
- 3) The study shall include input circuit data including conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.
- 4) Identification of the maximum available short-circuit current in rms symmetrical amperes and the X/R ratio of the fault current for each bus/branch calculation.
- 5) The system one-line diagram shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the analysis.

- 6) A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.
- 7) The contractor shall be responsible for supplying pertinent electrical system conductor, circuit breaker, generator, and other component and system information in a timely manner to allow the short-circuit analysis to be completed prior to final installation.
- 8) Any inadequacies shall be called to the attention of the engineer and recommendations made for improvements as soon as they are identified.

b. Protective Device Coordination Analysis:

- 1) The time-current coordination analysis shall be performed and will include the determination of settings, ratings, or types for the overcurrent protective devices supplied.
- 2) Where necessary, an appropriate compromise shall be made between system protection and service continuity with system protection and service continuity considered to be of equal importance.
- 3) Sufficient analysis shall be provided to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
- 4) Provide log-log plots containing descriptions for each of the devices shown, settings of the adjustable devices, the short-circuit current availability at the device location when known, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.
- 5) The study shall include a separate listing of the suggested device settings of all adjustable overcurrent protective devices, the equipment where the device is located, and the device number corresponding to the device on the system one-line diagram.
- 6) A computer-generated system one-line diagram shall be provided which clearly identifies individual equipment uses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.
- 7) A discussion section which evaluates the degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.

- 8) Significant deficiencies in protection and/or coordination shall be called to the attention of the engineer and recommendations made for improvements as soon as they are identified.
- 9) The contractor shall be responsible for supplying pertinent electrical system conductor, circuit breaker, generator, and other component and system information in a timely manner to allow the time-current analysis to be completed prior to final installation.
- c. Arc-Flash Hazard Analysis:
  - 1) The Arc-Flash Hazard Analysis shall be performed with the aid of computer software intended for this purpose in order to calculate Arc-Flash Incident Energy (AFIE) levels and flash protection boundary distances.
  - 2) The Arc-Flash Hazard Analysis shall be performed in conjunction with a short-circuit analysis and a time-current coordination analysis.
  - 3) Results of the Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.
  - 4) The analysis shall be performed under worst-case Arc-Flash conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.
  - 5) The Arc-Flash Hazard Analysis shall be performed by a registered professional engineer.
  - 6) The Arc-Flash Hazard Analysis shall be performed in compliance with IEEE Standard 1584-2002, the IEEE Guide for Performing Arc-Flash Calculations - NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.
  - 7) The Arc-Flash Hazard Analysis shall include recommendations for reducing AFIE levels and enhancing worker safety.
  - 8) The proposed vendor shall demonstrate experience with Arc-Flash Hazard Analysis by submitting names of at least ten actual Arc-Flash Hazard Analyses it has performed in the past year.
  - 9) The proposed vendor shall demonstrate capabilities in providing equipment, services, and training to reduce Arc-Flash exposure and train workers in accordance with NFPA 70E and other applicable standards.
  - 10) The proposed vendor shall demonstrate experience in providing equipment labels in compliance with NEC-2011 Section 110 and ANSI Z535.4 to identify AFIE and appropriate Personal Protective Equipment classes.
- d. Report which shall contain the following information:
  - 1) Executive summary identifying all work performed, along with any future design considerations.
  - 2) A complete tabulation of all protective devices identified on the single line diagram with their ratings compared with respective fault duty as calculated in the study.
  - 3) A complete tabulation of the settings recommended on all adjustable protective devices with references to the single line diagram and coordination curves.
  - 4) Copies of all time/current coordination curves.
  - 5) The analysis that was utilized in order to arrive at specified recommendations included in the executive summary.
  - 6) The single line diagram complete.
  - 7) Copies of all calculations and computer analysis results referenced to the single line diagram.
  - 8) Incident energy and flash protection boundary calculations
  - 9) Complete documentation of all testing results.
  - 10) Printed hard copy arc flash labels with electronic format copy.

### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.
- B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NEMA PB 2.
- F. Comply with NFPA 70.
- G. Comply with UL 891.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.
- B. If switchboards are stored in unheated conditions, remove loose packing and flammable materials from inside switchboards and install temporary electric heating (250 W per section) to prevent condensation.
- C. Handle and prepare switchboards for installation according to NECA 400.
- D. Protection: Provide supplemental heating devices, such as incandescent lamps or low wattage heaters within the enclosure or under a protective cover to control dampness. Maintain this protection from the time equipment is delivered to the site until it is energized.

#### 1.5 PROJECT CONDITIONS

- A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.
- B. Environmental Limitations:
  - 1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
  - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Not exceeding 104 deg F.
    - b. Altitude: Not exceeding 6600 feet.
- C. Service Conditions: NEMA PB 2, usual service conditions, as follows:
  - 1. Ambient temperatures within limits specified.
  - 2. Altitude not exceeding 6600 feet.
- D. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect, Construction Manager, and Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager's written permission.
4. Comply with NFPA 70E.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Submit drawings showing the location of electrical equipment supplied as part of this specification section that requires work space clearance in accordance with NFPA 70 Article 110 Part II. Work space clearance, including height, shall be indicated on the drawing, indicating where other trades are restricted from locating equipment, ductwork or piping. Locations for equipment furnished under this section may be shown on consolidated drawings submitted under Division 26 Section. These drawings shall be coordinated with the other trades through the General Contractor. Any changes to these drawings during the course of the construction shall be coordinated with all trades through the General Contractor prior to installing the equipment. Changes required by other trades as a result of lack of coordination through the General Contractor shall be borne by the Electrical Contractor.
- C. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

#### 1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
  1. Warranty Period: Five years from date of Substantial Completion.

#### 1.8 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
  2. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

5. Indicating Lights: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURED UNITS

- A. 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:
  1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
  5. Or Approved Equal.
- B. Front-Connected, Front-Accessible Switchboards:
  1. Main Devices: Panel mounted.
  2. Branch Devices: Panel mounted.
  3. Sections front and rear aligned.
  4. Front accessibility.
  5. Sections flush at rear (rear alignment).
  6. Main device: Stationary circuit breaker (see circuit breaker paragraph).
  7. Provisions for electric utility company metering current transformers. The utility current transformer compartment shall comply with Public Service Electric & Gas (PSE&G) construction specifications.
  8. Fully rated copper bus bars.
    - a. Ampere rating of through bus not less than frame size of main device.
  9. Full length copper ground bus.
  10. Full capacity copper neutral bus.
  11. Sections that are designated "space" or "provision for future breaker" equipped with all accessories required to accept a future circuit breaker.
  12. Space heaters with thermostatic control.
  13. Circuit Breakers:
    - a. Mounting: Group mounted, or individually mounted as necessary to accommodate the circuit breaker style and switchboard construction.
    - b. Style: Molded case, or power circuit breakers, as required to accommodate the circuit breaker components.
    - c. Trip Device: Programmable solid state.
    - d. Interrupting Capacity: Equal to, or greater than, the short circuit rating required for the switchboard.
    - e. Component Description: See switchboard schedule for specific components required for each circuit breaker. In addition to the specific components, equip each circuit breaker with additional components as required to achieve a coordinated selective scheme between the main device and the feeder devices
- C. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Indoor Enclosures: Steel, NEMA 250, Type 1.

- E. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
- F. Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements; hinged sealed door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.
- G. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
- H. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.
- I. Pull Box on Top of Switchboard:
  - 1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
  - 2. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
  - 3. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
  - 4. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.
- J. Buses and Connections: Three phase, four wire unless otherwise indicated.
  - 1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity or tin-plated, high-strength, electrical-grade aluminum alloy.
  - 2. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
  - 3. Ground Bus: 1/4-by-2-inch- hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
  - 4. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
  - 5. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
- K. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.
- L. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.



## 2.2 SURGE PROTECTIVE DEVICES

- A. General: Where indicated on the drawings, the switchboards shall be provided with factory installed directly to bus, internal modular Surge Protective Device (SPD) equipment having:
1. ANSI/UL 1449 3rd Edition compliant – Listed Category C, Type 2 with protected modes for 3 phase, 4 wire Wye configured system: L-G, L-N, L-L and N-G.
  2. Rating (ANSI / IEEE C62.41 location Category C): The minimum surge current capacity the device is capable of withstanding shall be 250 kA per phase, 125 kA per mode minimum.
- B. 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:
1. Controlled Power
  2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  4. Siemens Energy & Automation, Inc.
  5. Square D; a brand of Schneider Electric.
  6. Or Approved Equal.
- C. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, wired-in, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:
1. Fabrication using bolted compression lugs for internal wiring.
  2. Redundant suppression circuits.
  3. Redundant replaceable modules.
  4. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
  5. LED indicator lights for power and protection status.
  6. Audible alarm, with silencing switch, to indicate when protection has failed.
  7. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
- D. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.
- E. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
- F. Protection modes and UL 1449 SVR for grounded wye circuits with 208/120 -V, three-phase, four-wire circuits shall be as follows:
1. Line to Neutral: 800 V for 208/120
  2. Line to Ground: 800 V for 208/120 .
  3. Neutral to Ground: 800 V for 208/120

## 2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and  $I^2t$  response.
  4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
  6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
    - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    - e. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
    - f. Communication Capability: Universal-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
    - g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
    - h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
    - i. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
- B. Insulated-Case Circuit Breaker (ICCB): 80 percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.
1. Fixed circuit-breaker mounting.
  2. Two-step, stored-energy closing.
  3. Standard -function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time time adjustments.
    - c. Ground-fault pickup level, time delay, and  $I^2t$  response.
  4. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
  5. Remote trip indication and control.

6. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
  7. Control Voltage: 120-V ac.
- C. Bolted-Pressure Contact Switch: Operating mechanism uses rotary-mechanical-bolting action to produce and maintain high clamping pressure on the switch blade after it engages the stationary contacts.
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. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
    - b. Siemens Energy & Automation, Inc.
    - c. Square D; a brand of Schneider Electric.
    - d. Or Approved Equal.
  2. Main-Contact Interrupting Capability: Minimum of 12 times the switch current rating.
  3. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.
    - a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
  4. Auxiliary Switches: Factory installed, single pole, double throw, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
  5. Service-Rated Switches: Labeled for use as service equipment.
  6. Ground-Fault Relay: Comply with UL 1053; self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.
    - a. Configuration: Remote-mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    - b. Internal Memory: Integrates the cumulative value of intermittent arcing ground-fault currents and uses the effect to initiate tripping.
    - c. No-Trip Relay Test: Permits ground-fault simulation test without tripping switch.
    - d. Test Control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).
  7. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.
- D. High-Pressure, Butt-Type Contact Switch: Operating mechanism uses butt-type contacts and a spring-charged mechanism to produce and maintain high-pressure contact when switch is closed.
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. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
    - b. Or Approved Equal.
  2. Main-Contact Interrupting Capability: Minimum of 12 times the switch current rating.

3. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.
    - a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
  4. Auxiliary Switches: Factory installed, single pole, double throw, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
  5. Service-Rated Switches: Labeled for use as service equipment.
  6. Ground-Fault Relay: Comply with UL 1053; self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.
    - a. Configuration: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    - b. Internal Memory: Integrates the cumulative value of intermittent arcing ground-fault currents and uses the effect to initiate tripping.
    - c. No-Trip Relay Test: Permits ground-fault simulation test without tripping switch.
    - d. Test Control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).
  7. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.
- E. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
- F. Fuses are specified in Division 26 Section "Fuses."

## 2.4 INSTRUMENTATION

- A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:
1. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; wound, bushing, bar or window type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
  2. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
  3. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.
- B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
    - a. Phase Currents, Each Phase: Plus or minus 1 percent.
    - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
    - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
    - d. Megawatts: Plus or minus 2 percent.
    - e. Megavars: Plus or minus 2 percent.

- f. Power Factor: Plus or minus 2 percent.
  - g. Frequency: Plus or minus 0.5 percent.
  - h. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
  - i. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.
  - j. Contact devices to operate remote impulse-totalizing demand meter.
2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

C. Impulse-Totalizing Demand Meter:

- 1. Comply with ANSI C12.1.
- 2. Suitable for use with switchboard watt-hour meter, including two-circuit totalizing relay.
- 3. Cyclometer.
- 4. Four-dial, totalizing kilowatt-hour register.
- 5. Positive chart drive mechanism.
- 6. Capillary pen holding a minimum of one month's ink supply.
- 7. Roll chart with minimum 31-day capacity; appropriate multiplier tag.
- 8. Capable of indicating and recording 15 -minute integrated demand of totalized system.

## 2.5 CONTROL POWER

- A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

## 2.6 ACCESSORY COMPONENTS AND FEATURES

- A. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Receive, inspect, handle, and store switchboards according to NEMA Publication No. PB2.1.
- B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.
- C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Install switchboards in accordance with NEMA Publication No. PB2.1 "Instructions for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards".
  - 1. Set and program the switchboard devices in accordance with the approved coordinated selective scheme.
- B. Equipment Mounting: Install switchboards on concrete base, 4-inch minimum nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete".
  - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to switchboards.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.
- C. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.
- E. Install filler plates in unused spaces of panel-mounted sections.
- F. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.
  - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- G. Identification:
  - 1. Install on the front of each circuit breaker, a phenolic nameplate indicating load served by circuit breaker.
  - 2. Stencil on front of each switchboard with white paint in 1/2 inch lettering "SB-1, etc." corresponding to switchboard designations on the drawings, and electrical parameters (phase, wire, voltage).
- H. Grounding: Connections: Ground switchgear ground bus to common building ground as indicated on the Drawings.
- I. Connections: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where these values are not indicated, use those specified in UL 486A and UL 486B.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
    - c. Instruments and Equipment:
      - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Switchboard will be considered defective if it does not pass tests and inspections.

- E. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as recommended by manufacturer.

### 3.6 PROTECTION

- A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

### 3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF SECTION 262413



## SECTION 262416 – PANELBOARDS

### PART 1 - GENERAL

#### 1.1 REFERENCES

- A. The latest edition of: NEMA PB-1, UL-50, UL-67, ANSI C37.81.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.
  - 3. Electronic-grade panelboards.

#### 1.3 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. MCCB: Molded-case circuit breaker
- C. SS: Transient voltage surge suppressor.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
  - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
  - 3. Detail bus configuration, current, and voltage ratings.
  - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
  - 5. Include evidence of NRTL listing for series rating of installed devices.
  - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 7. Include wiring diagrams for power, signal, and control wiring.
  - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.
- C. Quality Control Submittals:

1. List of Completed Installations: If brand names other than those specified are proposed for use, furnish the name, address, and telephone number of at least 5 comparable installations that can prove the proposed products have operated satisfactorily for one year.
  2. Company Field Advisor Data: Include:
    - a. Name, business address and telephone number of Company Field Advisor secured for the required services.
    - b. Certified statement from the Company listing the qualifications of the Company Field Advisor.
    - c. Services and each product for which authorization is given by the Company listed specifically for this project.
- D. Contract Closeout Submittals:
1. System acceptance test report.
  2. Certificate: Affidavit, signed by the Company Field Advisor and notarized, certifying that the system meets the contract requirements and is operating properly.
1. 3. Operation and Maintenance Data: Deliver 2 copies, covering the installed products, to the Engineer
- E. Remaining paragraphs are defined in Division 01 Section "Submittal Procedures" as "Informational Submittals."
- F. Qualification Data: For qualified testing agency.
- G. Field Quality-Control Reports:
1. Test procedures used.
  2. Test results that comply with requirements.
  3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- H. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- I. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards. If panelboards are stored in an unconditioned area during cold weather, install temporary electric heating (1 W per 250 cubic inches of panelboard space) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NECA 407.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations:
  - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
  - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
    - b. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
  - 1. Ambient temperatures within limits specified.
  - 2. Altitude not exceeding 6600 feet.
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Architect, Construction Manager and Owner no fewer than (14) fourteen days in advance of proposed interruption of electric service.
  - 2. Do not proceed with interruption of electric service without Construction Manager's written permission.
  - 3. Comply with NFPA 70E.

#### 1.8 COORDINATION

- A. 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, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

## 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

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

## 1.10 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: One spare of each type for each panelboard. Size shall be the most common size in the panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.
  - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
  - b. Outdoor Locations: NEMA 250, Type 3R.
  - c. Kitchen and Wash-Down Areas: NEMA 250, Type 3R.
  - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Finishes:
  - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
  - b. Back Boxes: Galvanized steel.
  - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
4. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

- B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Neutral Bus: Neutral bus rated 100 percent of phase bus and UL listed as suitable for nonlinear loads.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Neutral Lugs: Rated 100 percent of phase lugs mounted on neutral bus.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: All spaces shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

2.2 Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. As produced by Cutler-Hammer/Eaton Corp. with LT Trim (Eaton EZ Trim shall not be considered), General Electric Co., Siemens or Square D Co., having:

1. Flush or surface type cabinets as indicated on the drawings.
2. Increased gutter space for gutter taps, sub-feed wiring, through-feed wiring, oversize lugs.
3. SUITABLE FOR USE AS SERVICE EQUIPMENT where used as service equipment.
4. Door and one piece trim. Door fastened to trim with butt or piano hinges. Trim fastened to cabinet with devices having provision for trim adjustment.
5. Yale No. 511S locks with brass cylinder rosette, blind fastened from inside of door. 2 No. 47 keys with each lock (Exception: Not more than 7 keys, total) or approved equal.
6. Solid copper bus bars. Ampere rating of bus bars not less than frame size of main circuit breaker.
7. Ratings as indicated on the drawings.
8. Full capacity copper neutral bus where neutrals are required.
9. Copper equipment grounding bus.
10. Sections designated "space" or "provision for future breaker" equipped to accept future circuit breakers.
11. Lock on devices for exit light, fire alarm, stair well circuits.
12. Provisions for padlocking circuit breaker handle in OFF position where indicated.
13. Directory.

14. Short circuit rating not less than indicated on panelboard schedule. Furnish fully rated equipment (the short circuit rating of the panelboard is equal to the lowest interrupting rating of any device installed in the panelboard).
15. Thermal magnetic, molded case, bolt-on circuit breakers:
  - a. Mounting: Individually mounted main circuit breaker (when MCB is required), and group mounted branch/feeder circuit breakers to accommodate the circuit breaker style and panelboard construction.
  - b. Components: See panelboard schedule for specific components required for each circuit breaker. In addition to the specific components, equip each circuit breaker with additional components as required to achieve a coordinated selective scheme between the main circuit breaker and the branch/feeder circuit breakers.
  - c. Single pole 15 ATE and 20 ATE circuit breakers marked SWD where used as switches.
  - d. Single pole and two pole 15, 20, and 30 ATE circuit breakers rated for high intensity discharge lighting loads when applicable.

## 2.3 NAMEPLATES

- A. General: Precision engrave letters and numbers with uniform margins, character size minimum 3/16 inch high.
  1. Phenolic: Two color laminated engravers stock, 1/16 inch minimum thickness, machine engraved to expose inner core color (white).
  2. Aluminum: Standard aluminum alloy plate stock, minimum .032 inches thick, engraved areas enamel filled or background enameled with natural aluminum engraved characters.
  3. Materials for Outdoor Applications: As recommended by nameplate manufacturer to suit environmental conditions.

## 2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
  5. Or Approved Equal.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
  1. For doors more than 36 inches high, provide two latches, keyed alike.
- D. Mains: Circuit breaker or Lugs only as shown on drawings.
- E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

## 2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
  - 5. Or Approved Equal.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only as shown on drawings.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
  - 1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
- F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

## 2.4 ELECTRONIC-GRADE PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
  - 5. Or Approved Equal.
- B. Panelboards: NEMA PB 1; with factory-installed, integral SS; labeled by an NRTL for compliance with UL 67 after installing SS.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- D. Main Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.
- E. Branch Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.
- F. Buses:
  - 1. Copper phase and neutral buses; 100 percent capacity neutral bus and lugs.

## 2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
  5. Or Approved Equal.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and  $I^2t$  response.
  4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
  6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
  7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
  8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    - d. Ground-Fault Protection: Relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    - e. Shunt Trip: 24 -V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
    - f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
    - g. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
    - h. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.



- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 26 Section "Fuses."
  2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
  3. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

## 2.6 PANELBOARD SUPPRESSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Current Technology; a subsidiary of Danahar Corporation.
  2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  4. Liebert Corporation.
  5. Siemens Energy & Automation, Inc.
  6. Square D; a brand of Schneider Electric.  
Or Approved Equal.
- B. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, wired-in, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:
1. Accessories:
    - a. Fuses rated at 250-kA interrupting capacity.
    - b. Fabrication using bolted compression lugs for internal wiring.
    - c. Integral disconnect switch.
    - d. Redundant suppression circuits.
    - e. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
    - f. LED indicator lights for power and protection status.
    - g. Audible alarm, with silencing switch, to indicate when protection has failed.
    - h. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
  2. Peak Single-Impulse Surge Current Rating: 125 kA per mode/250 kA per phase.
  3. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.
    - a. Line to Neutral: 70,000 A.
    - b. Line to Ground: 70,000 A.
    - c. Neutral to Ground: 50,000 A.
  4. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
  5. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 or 208Y/120 -V, three-phase, four-wire circuits shall be as follows:
    - a. Line to Neutral: 800 V for 480Y/277 or 400 V for 208Y/120.

- b. Line to Ground: 800 V for 480Y/277 or 400 V for 208Y/120.
- c. Neutral to Ground: 800 V for 480Y/277 or 400 V for 208Y/120.

## 2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards in accordance with NEMA Publication No. PB1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install panelboards in accordance with NEMA Publication No. PB1.1 "General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less".
- B. Flush Cabinets: Set flush cabinets so that edges will be flush with the finished wall line. Where space will not permit flush type cabinets to be set entirely in the wall, set cabinet as nearly flush as possible, and cover the protruding sides with the trim extending over the exposed sides of the cabinet and back to the finished wall line.
- C. Directory: Indicate on typewritten directory the equipment controlled by each circuit breaker, and size of feeder servicing panelboard. For power panelboards also include ATE rating and feeder size for each breaker.
- D. Remove the neutral to ground main/system bonding jumper unless the panelboard is used for a service entrance or if the panel is fed by a separately derived system. Turn the bonding jumper over to the Engineer.
- E. Identification:
  - 1. Use nameplates, or stencil on front of each panelboard with white paint, "LV-1\*", HV-1\*", etc." in 1/2 inch lettering corresponding to panelboard designations on the drawings, and electrical parameters (phase, wire, voltage).

2. Install a nameplate on each panelboard that explains the means of identifying each ungrounded system conductor by phase and system. Examples of nameplate statements:
  - a. Identification of 120/208 Volt Circuit Conductors:  
2 wire circuit - white\*, black, white.  
3 wire circuit - white\*, black, red, white.  
4 wire circuit - white\*, black, red, blue, white

\*White is used only as neutral. Where neutral is not required, black, red, or black, red, blue is used for phase to phase circuits.

- b. Identification of 277/480 Volt Circuit Conductors:  
2 wire circuit - natural gray\*\*, brown, gray.  
3 wire circuit - natural gray\*\*, brown, yellow, gray.  
4 wire circuit - natural gray\*\*, brown, yellow, orange, gray

\*\*Natural gray is used only as neutral. Where neutral is not required, brown, yellow, or brown, yellow, orange is used for phase to phase circuits.

- A. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration Controls for Electrical Systems."
- B. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- C. Install overcurrent protective devices and controllers not already factory installed.
  1. Set field-adjustable, circuit-breaker trip ranges.
- D. Install filler plates in unused spaces.
- E. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- F. Arrange conductors in gutters into groups and bundle and wrap loosely with wire ties after completing load balancing.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing of surge suppressors and other electronic devices with adjustment capabilities.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit. ANY PANEL WITH INTEGRAL SS UNIT SHALL HAVE SS UNIT DISCONNECTED PRIOR TO ANY MEGGAR TESTING.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Instruments and Equipment:
      - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study."
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
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.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
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.

### 3.6 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416



## SECTION 262726 – WIRING DEVICES

### 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. This Section includes the following:
  - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. Wall-box motion sensors.
  - 3. Snap switches and wall-box dimmers.
  - 4. Wall-switch and exterior occupancy sensors.
  - 5. Cord and plug sets.
  - 6. Multioutlet assemblies.
- B. Related Sections include the following:
  - 1. Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

#### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. 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.
- C. Comply with NFPA 70.

## 1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 1. Cord and Plug Sets: Match equipment requirements.

## 1.7 EXTRA MATERIALS

- A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
  - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
  - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  - 3. Leviton Mfg. Company Inc. (Leviton).
  - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).
  - 5. Or Approved Equal.

### 2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
  - 1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. Cooper; 5351 (single), 5352 (duplex).
    - b. Hubbell; HBL5351 (single), CR5352 (duplex).
    - c. Leviton; 5891 (single), 5352 (duplex).
    - d. Pass & Seymour; 5381 (single), 5352 (duplex).
    - e. Or Approved Equal.



## 2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
  - 1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. Cooper; XGF20.
    - b. Hubbell; GF5352.
    - c. Leviton; 6898.
    - d. Pass & Seymour; 2084.
    - e. Bryant
    - f. Or Approved Equal.

## 2.4 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
  - 1. Cord: Furnished on equipment provided by owner.
  - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

## 2.5 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
  - 1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
    - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
    - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
    - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
- C. Pilot Light Switches, 20 A:
  - 1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. Cooper; 2221PL for 120 V and 277 V.
    - b. Hubbell; HPL1221PL for 120 V and 277 V.
    - c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
    - d. Pass & Seymour; PS20AC1-PLR for 120 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide products by one of the following:
  - a. Cooper; 2221L.
  - b. Hubbell; HBL1221L.
  - c. Leviton; 1221-2L.
  - d. Pass & Seymour; PS20AC1-L.
2. Description: Single pole, with factory-supplied key in lieu of switch handle.

## 2.6 RECEPTACLES

A. Specification Grade Receptacles:

1. Single receptacle, NEMA 5-15R (15A, 125 V, 2P, 3W); Bryant's 5251, Crouse-Hinds/AH's 5251, Hubbell's 5251, Leviton's 5251, Pass & Seymour's 5251, or approved equal.
2. Duplex receptacle, NEMA 5-15R (15A, 125 V, 2P, 3W); Bryant's 5252/5242, Crouse-Hinds/AH's 5252/5242, Hubbell's 5252/5242, Leviton's 5252/5242, Pass & Seymour's 5252/5242, or approved equal.
3. Single receptacle, NEMA 5-20R (20A, 125 V, 2P, 3W); Bryant's 5361/5351, Crouse-Hinds/AH's 5361/5351, Hubbell's 5361/5351, Leviton's 5361/5351, Pass & Seymour's 5351, or approved equal.
4. Duplex receptacle, NEMA 5-20R (20A, 125 V, 2P, 3W); Bryant's 5362, Crouse-Hinds/AH's 5352/5342, Hubbell's 5352, Leviton's 5352, Pass & Seymour's 5352, or approved equal.

B. Electric Clock Receptacles:

1. Single receptacle, NEMA 5-15R (15A, 125 V, 2P, 3W), brass or stainless steel face plate to match hardware; Bryant's 2828-G, 2828-GS, Crouse-Hinds/AH's 5708, Hubbell's 5233, 5235, Leviton's 5261-CH, Pass & Seymour's S3733, S3733-SS, or approved equal.

C. Ground Fault Interrupter Receptacles:

1. Duplex receptacle rated 15A (NEMA 5-15R), circuit-ampacity 20A; Bryant's GFR52FT, Crouse-Hinds/AH's GF5242, Hubbell's GF5252, Leviton's 6599, Pass & Seymour's 1591S, Daniel Woodheads 5252GF, or approved equal.
2. Duplex receptacle rated 20A (NEMA 5-20R), circuit ampacity 20A; Bryant's GFR53FT, Crouse-Hind/AH's GF5342, Hubbell's GF 5352, Leviton's 6899, Pass & Seymour's 2091S, Daniel Woodheads 5352GF, or approved equal.

D. Weather Resistant Ground Fault Interrupter Receptacles:

1. Duplex receptacle rated 15A (NEMA 5-15R), circuit-ampacity 20A; Cooper's WRVGF15W, Leviton's 002-W7599-00W, or approved equal.
2. Duplex receptacle rated 20A (NEMA 5-20R), circuit ampacity 20A; Cooper's WRVGF20W, Leviton's 002-W7899-00W, or approved equal.

E. Special Purpose Receptacles: Furnish matching nylon, polycarbonate or armored plug with each receptacle. Furnish matching wall plate with each receptacle (.040" brass, Type 302 stainless steel, weatherproof, threaded box type, as required):

1. Type A: NEMA 14-20R (3P, 4W, 20A, 125/250 V, W/G); Crouse-Hinds/AH's 5759, General Electric's 1420, Hubbell's 8410, or approved equal
2. Type B: NEMA 14-30R (3P, 4W, 30A, 125/250 V, W/G); Bryant's 9430FR, Crouse-Hinds/AH's 5744N, Hubbell's 9430A, Leviton's 278, Pass & Seymour's 3864, or approved equal.
3. Type C: NEMA 14-50R (3P, 4W, 50A, 125/250 V, W/G); Bryant's 9450FR, Crouse-Hinds/AH's 5754N, Hubbell's 9450A, Leviton's 279, Pass & Seymour's 3894, or approved equal.
4. Type D: NEMA 14-60R (3P, 4W, 60A, 125/250 V, W/G); Bryant's 9460FR, Crouse-Hinds/AH's 9460N, Hubbell's 9460A, Pass & Seymour's 3871, or approved equal.
5. Type E: NEMA 10-20R (3P, 3W, 20A, 125/250 V); Bryant's 9326, Crouse-Hinds/AH's 9140, Hubbell's 6810, Pass & Seymour's 6810, or approved equal.
6. Type F: NEMA 10-30R (3P, 3W, 30A, 125/250 V); Bryant's 9303, Crouse-Hinds/AH's 9344N, Hubbell's 9350, Leviton's 5207, Pass & Seymour's 3860, or approved equal.
7. Type G: NEMA 10-50R (3P, 3W, 50A, 125/250 V); Bryant's 9306, Crouse-Hinds/AH's 7985N, Hubbell's 7962, Leviton's 5206GR, Pass & Seymour's 3890, or approved equal.
8. Type H: NEMA L5-15R (2P, 3W, 15A, 125 V, W/G); Bryant's 4710, Crouse-Hinds/AH's 4710, Hubbell's 4710, Pass & Seymour's 4710, or approved equal.
9. Type I: NEMA L5-20R (2P, 3W, 20A, 125 V, W/G); Bryant's 70520FR, Crouse-Hinds/AH's 6200, Hubbell's 2310A, Pass & Seymour's L520-R, or approved equal.
10. Type J: NEMA L5-30R (2P, 3W, 30A, 125 V, W/G); Bryant's 70530FR, Crouse-Hinds/AH's 6330, Hubbell's 2610A, Leviton's 70530-FR, Pass & Seymour's L530-R, or approved equal.
11. Type K: NEMA L6-15R (2P, 3W, 15A, 250 V, W/G); Bryant's 70615FR, Crouse-Hinds/AH's 6560, Hubbell's 4560, Leviton's 70615FR, Pass & Seymour's 4560, or approved equal.
12. Type L: NEMA L6-20R (2P, 3W, 20A, 250 V, W/G); Bryant's 70620FR, Crouse-Hinds/AH's 6210, Hubbell's 2320A, Leviton's 70620-FR, Pass & Seymour's L620-R, Slater's L620R, or approved equal.
13. Type M: NEMA L6-30R (2P, 3W, 30A, 250 V, W/G); Bryant's 70630FR, Crouse-Hinds/AH's 6340, Hubbell's 2620, Pass & Seymour's L630-R, or approved equal.

## 2.6 WALL PLATES

### A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting .
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with lift cover, and listed and labeled for use in "wet locations while in use."

Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant while in use, die-cast aluminum with lockable cover.

### B. Brass Wall Plates: .040 inch thick brass with brush brass finish; Bryant's 518 Series, Hubbell's B Series or 94 Series, Leviton's 81 Series, Pass & Seymour's B Series, or approved equal.

- C. Stainless Steel Wall Plates: Type 302 stainless steel with satin finish; Bryant's 93 Series, Crouse-Hinds/AH's 93 Series, Hubbell's 93 Series, Leviton's 910 -40 Series, Pass & Seymour's 93 Series, or approved equal.
- D. Weatherproof Covers: Crouse-Hinds WLRS, WLRD, Hubbell's 52, 74 Series, Pass & Seymour's 45 Series, or approved equal.
- E. Weatherproof While In Use Covers:
  - 1. Polycarbonate: Cooper Crouse-Hinds TP7488W, Pass & Seymour's (Legrand) WIUC10C, or approved equal.
  - 2. Metallic: Hubbell's WP826 or WP826H, Thomas and Betts' (Red Dot) CKMUV or CKMU, Leviton's M5979-0GY or M5999-0GY, or approved equal
- F. Covers for Threaded Type Boxes: Stamped sheet steel, gasketed device covers as produced by Crouse-Hinds Co., OZ/Gedney Co., or approved equal.+++++++

## 2.7 EMERGENCY SHUTDOWN SWITCHES

- A. Emergency Shutdown Pushbutton Switch: Square D. Co.'s Class 9001 or approved equal, Type K, pushbutton operator with the following:
  - 1. Red mushroom button.
  - 2. Transformer type red pilot light.
  - 3. Legend red plate with words "Emerg. Stop".
  - 4. NEMA 13 oil tight enclosure with cover riveted to box.
- B. Emergency Shutdown Key Operated Switch: Square D. Co.'s Class 9001 or approved equal, Type K, key operated selector switch with the following:
  - 1. Key removable in both "ON" and "OFF" position.
  - 2. NEMA 13 oil tight enclosure with cover riveted to box.

## 2.8 NAMEPLATES

- A. Phenolic Type: Standard phenolic nameplates with 3/16 inch minimum size lettering engraved thereon.
- B. Embossed Aluminum: Standard stamped or embossed aluminum tags, 3/16 inch minimum size lettering, as produced by Seton Name Plate Corp. or Tech Products Inc.

## 2.9 FLOOR SERVICE FITTINGS

- A. Service fittings in first paragraph below are available for voice and data communication cabling as well as for power. Edit to suit Project.
- B. Type: Modular, flush-type , dual-service units suitable for wiring method used.
- C. Compartments: Barrier separates power from voice and data communication cabling.
- D. Service Plate: Round, solid brass with satin finish.

- E. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish for general receptacles; white for computer receptacles, unless otherwise indicated.
- F. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 Category 6 jacks for UTP cable.

## 2.10 MULTIOUTLET ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hubbell Incorporated; Wiring Device-Kellems.
  - 2. Wiremold Company (The).
  - 3. Or Approved Equal.
- B. If not indicated on Drawings, add mounting heights, raceway sizes, and types and spacing of receptacle devices to paragraph below. Add descriptions of special features in assemblies such as fused receptacles, special-purpose switches, and channels for communication wiring.
- C. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- D. Raceway Material: As shown on plans.
- E. Wire: No. 12 AWG.

## 2.7 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
  - 1. Wiring Devices connected for general duty shall be grey; connected for computers shall be white, unless otherwise indicated or required by NFPA 70 or device listing.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Install wiring devices in outlet boxes.
- B. Local Switches:
  - 1. Install local switches rated 15A, 120/277 V ac for switches unless otherwise shown on the drawings or specified.
  - 2. Install switches indicated Sa, Sb, Sc, etc, for control of outlets, with corresponding letters on the same circuit.
  - 3. Where more than one switch occurs at same location in a 120 volt system, arrange switches in gangs and cover with one face plate.
  - 4. Install switches in a 277 volt system in separate single boxes if voltage between exposed live metal parts of adjacent switches exceeds 300 volts.

5. Install single and double pole switches so that switch handle is up when switch is in the "On" position.
  6. Install key operated switches where shown on the drawings.
- C. Receptacles:
1. Install Specification Grade receptacles, NEMA 5-15R, 15A, 125 V, 2P, 3W, for duplex receptacles and single receptacles unless otherwise shown on the drawings or specified.
  2. Install receptacles with ground pole in the down position.
  3. Install Weather Resistant Ground Fault Interrupter Receptacles in wet and damp locations.
- D. Wall Plates:
1. Install wall plates on all wiring devices in dry locations, with finish to match hardware in each area.
  2. Install hospital wall plates on Type HG receptacles.
  3. Install blank wall plates on outlet boxes which are for future equipment except telephone outlets.
  4. Install 5/8 inch bushed wall plates on telephone outlets.
  5. Fasten wall plates with vandal resistant screws in patients' area. Deliver 10 screw keys to the facility.
- E. Weatherproof Covers: Install weatherproof covers on wiring devices in damp locations.
- F. Weatherproof While In Use Covers: Install weatherproof while in use covers on wiring devices in wet locations.
- G. Nameplates: Provide phenolic or embossed aluminum nameplate for each special purpose receptacle indicating phase, ampere and voltage rating of the circuit. Attach nameplate with rivets or tamperproof fasteners to wall plate or to wall above receptacle. Wall plates may be engraved with required data in lieu of separate nameplates.
- H. Mats: Where flush plates are required over outlet boxes that cannot be set deep enough for the plates to fit closely over the finished wall surfaces, provide oak mats to fill the space between the finished wall surface and the plate.
- I. Receptacles On Emergency Circuits: Install red colored receptacles. Engrave faceplates "EMERGENCY" in 3/16 inch high lettering and fill engraving with contrasting color filler material.
- A. Coordination with Other Trades:
1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
  2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  4. Install wiring devices after all wall preparation, including painting, is complete.
  5. Alternatively, if installed before wall repair or painting; provide protective covers for the devices. Replace any devices that have mortar, wallboard compound or are painted on visible or operative surfaces.

6. Openings or cuts around boxes, in wallboard or block walls, shall not exceed 1/8 inch. Coordinate repair of wall surface to match surrounding to comply with this requirement.

B. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
  - a. Cut back and pigtail or replace all damaged conductors.
  - b. Straighten conductors that remain and remove corrosion and foreign matter.
  - c. Pigtailling existing conductors is permitted provided the outlet box is large enough.

C. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

D. Receptacle Orientation:

1. Install ground pin GFCI receptacles so that wording is oriented for normal reading. Install ground pin of vertically mounted standard receptacles to match the orientation of GFCI receptacles.

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening. No opening in the wall shall be visible around the plate.

F. 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.

G. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### 3.2 IDENTIFICATION

#### A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Write on inside of device plate with indelible marker and use durable wire markers or tags inside outlet boxes.

### 3.3 FIELD QUALITY CONTROL

#### A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

#### B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

#### C. Test straight blade convenience outlets in patient-care areas for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.

END OF SECTION 262726



## SECTION 262812 – SAFETY SWITCHES

### PART 1 - GENERAL

#### 1.01 SUBMITTALS

- A. Product Data: Catalog sheets, specifications and installation instructions.

### PART 2 - PRODUCTS

#### 2.01 SAFETY SWITCHES (SINGLE THROW)

- A. NEMA 1, 3R, 4 (Stainless Steel), 12: Eaton/ Cutler-Hammer Inc.'s Heavy Duty Series, General Electric Co.'s Heavy Duty Series, Siemens Inc.'s Heavy Duty Series, Square D Co.'s Heavy Duty Series, or approved equal; having:
  - 1. Fuses, or unfused as indicated on drawings.
  - 2. Fused switches equipped with fuseholders to accept only the fuses specified in Section 262813 (UL Class RK-1, RK-5, L).
  - 3. NEMA 1 enclosure unless otherwise indicated on drawing.
  - 4. 240V rating for 120V, 208V, or 240V, circuits.
  - 5. 600V rating for 277V, or 480V circuits.
  - 6. Solid neutral bus when neutral conductor is included with circuit.
  - 7. Ground bus when equipment grounding conductor is included with circuit.
  - 8. Current rating and number of poles as indicated on drawings.
- B. NEMA 4X: Crouse-Hinds Co.'s NST, Square D Co.'s Heavy Duty Special Application Safety Switches, or approved equal; having:
  - 1. Fuses, or unfused as indicated on drawings.
  - 2. Fused switches equipped with fuseholders to accept only the fuses specified in Section 262813 (UL Class RK-1, RK-5, L).
  - 3. Molded fiberglass-reinforced polyester NEMA 4X enclosure.
  - 4. 240V rating for 120V, 208V, or 240V, circuits.
  - 5. 600V rating for 277V, or 480V circuits.
  - 6. Solid neutral bus when neutral conductor is included with circuit.
  - 7. Ground bus when equipment grounding conductor is included with circuit.
  - 8. Current rating and number of poles as indicated on drawings.

#### 2.02 NAMEPLATES

- A. General: Precision engrave letters and numbers with uniform margins, character size minimum 3/16 inch high.
  - 1. Phenolic: Two color laminated engravers stock, 1/16 inch minimum thickness, machine engraved to expose inner core color (white).
  - 2. Aluminum: Standard aluminum alloy plate stock, minimum .032 inches thick, engraved areas enamel filled or background enameled with natural aluminum engraved characters.
  - 3. Materials for Outdoor Applications: As recommended by nameplate manufacturer to suit environmental conditions.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install switches so that the maximum height above the floor to the center of the operating handle does not exceed 6'-6".
- B. Identify each safety switch, indicating purpose or load served:
  - 1. NEMA 1 Enclosures: Rivet or bolt nameplate to the cover.
  - 2. NEMA 12 Enclosures: Rivet or bolt and gasket nameplate to the cover.
  - 3. NEMA 3R, 4, 4X Enclosures: Attach nameplate to the cover using adhesive specifically designed for the purpose, or mount nameplate on wall or other conspicuous location adjacent to switch. Do not penetrate enclosure with fasteners.
- C. Paint switches used for the fire protective signaling system with red paint and identify - "FIRE ALARM CIRCUIT CONTROL".
- D. Paint switches used for oil burner emergency switch with red paint and identify "OIL BURNER".

END OF SECTION 262812

## SECTION 262813 – FUSES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Cartridge fuses rated 600 V and less.

#### 1.2 SUBMITTALS

- A. Product Data: For each fuse type indicated.
- B. Operation and maintenance data.

#### 1.3 MAINTENANCE

- A. Spare Parts:
  - 1. Six spare fuses of each size and category, including any accessories required for a complete installation.
  - 2. Special tools if required for installation or removal of fuses.

#### 1.4 QUALITY ASSURANCE

- A. 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.
- B. Comply with NEMA FU 1.
- C. Comply with NFPA 70.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Bussman, Inc.
  - 2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
  - 3. Ferraz Shawmut, Inc.
  - 4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.
  - 5. Or Approved Equal.

## 2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage

## 2.3 FUSE HOLDERS

- A. Equipment provided shall be furnished with fuse holders to accommodate the fuses specified.

## 2.4 FUSES RATED 600V OR LESS

- A. Fuses for Safety Switches (Motor, Lighting and Heating Circuits) and Service Disconnects:
  - 1. Cartridge Type (250 Volts, 600 Amperes or Less): Dual element time-delay, UL Class RK-1, 200,000 amperes R.M.S. symmetrical interrupting capacity:
    - a. Mersen Inc.'s Type A2D-R.
    - b. Cooper Industries Inc.'s/Bussman Div. Type LPN-RK-SP.
    - c. Littlefuse Inc.'s Type LLNRK.
    - d. Or approved equal
  - 2. Cartridge Type (600 Volts, 600 Amperes or Less): Dual element time-delay, UL Class RK-1, 200,000 amperes R.M.S. symmetrical interrupting capacity:
    - a. Mersen Inc.'s Type A6D-R.
    - b. Cooper Industries Inc.'s/Bussmann Div. Type LPS-RK-SPI.
    - c. Littlefuse Inc.'s Type LLSRK-ID.
    - d. Or approved equal
  - 3. Cartridge Type (600 Volts or Less - Above 600 Amperes): Current limiting, UL Class L, 200,000 amperes R.M.S. symmetrical interrupting capacity:
    - a. Mersen Inc.'s Type A4BQ.
    - b. Cooper Industries Inc.'s/Bussmann Div. Type KRP-C.
    - c. Littlefuse Inc.'s Type KLPC.
    - d. Or approved equal

## PART 3 - EXECUTION

### 3.1 FUSE APPLICATIONS

- A. Service Entrance: Class L, time delay 6r J, time delay.
- B. Feeders: Class L, time delay 6r J, time delay.
- C. Motor Branch Circuits: Class RK5, time delay.
- D. Other Branch Circuits: Class RK5, time delay 6r J, time delay.

### 3.2 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

### 3.3 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 262813



## SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Shunt trip switches.
  - 4. Molded-case circuit breakers (MCCBs).
  - 5. Enclosures.

#### 1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.

#### 1.4 SUBMITTALS

- A. 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, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Include evidence of NRTL listing for series rating of installed devices.
  - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
  - 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Qualification Data: For qualified testing agency.
- D. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. 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.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
  2. Altitude: Not exceeding 6600 feet.

## 1.7 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Submit drawings showing the location of electrical equipment supplied as part of this specification section that requires work space clearance in accordance with NFPA 70 Article 110 Part II. Work space clearance, including height, shall be indicated on the drawing, indicating where other trades are restricted from locating equipment, ductwork or piping. Locations for equipment furnished under this section may be shown on consolidated drawings submitted under Division 26 Section "BASIC ELECTRICAL REQUIREMENTS." These drawings



shall be coordinated with the other trades through the General Contractor. Any changes to these drawings during the course of the construction shall be coordinated with all trades through the General Contractor prior to installing the equipment. Changes required by other trades as a result of lack of coordination through the General Contractor shall be borne by the Electrical Contractor.

## 1.8 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  - 2. Fuse Pullers: Two for each size and type.

## PART 2 - PRODUCTS

### 2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Specific fuse types noted on the drawings shall override general requirements of Division 26 section "FUSES."
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
  - 5. Or Approved Equal.
- B. Type HD, Heavy Duty, Single Throw, 240 and 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
  - 3. Lugs: Mechanical type, suitable for number, size, and conductor material.
  - 4. Service-Rated Switches: Labeled for use as service equipment.

### 2.2 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.
  5. Or Approved Equal.
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  2. Lugs: Mechanical type, suitable for number, size, and conductor material.

## 2.3 SHUNT TRIP SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Bussmann, Inc.
  2. Ferraz Shawmut, Inc.
  3. Littelfuse, Inc.
  4. Or Approved Equal.
- B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
- C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
- E. Accessories:
1. Oiltight key switch for key-to-test function.
  2. Oiltight green ON pilot light.
  3. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
  4. Form C alarm contacts that change state when switch is tripped.
  5. Three-pole, double-throw, fire-safety and alarm relay; 24-V dc coil voltage.
  6. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

## 2.4 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.

5. Or Approved Equal.

- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
  - 1. Instantaneous trip.
  - 2. Long- and short-time pickup levels.
  - 3. Long- and short-time time adjustments.
  - 4. Ground-fault pickup level, time delay, and  $I^2t$  response.
- F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- G. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- H. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- I. Features and Accessories:
  - 1. Standard frame sizes, trip ratings, and number of poles.
  - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
  - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered or remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  - 5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
  - 6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
  - 7. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

## 2.5 MOLDED-CASE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.
  5. Or Approved Equal.
- B. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- C. Features and Accessories:
1. Standard frame sizes and number of poles.
  2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
  5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
  6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.

## 2.6 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
  2. Outdoor Locations: NEMA 250, Type 3R.
  3. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
  4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
  5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

- D. Install fuses in fusible devices.
- E. Comply with NECA 1.

### 3.3 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
  - 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study".

END OF SECTION 262816

## SECTION 265100 – LIGHTING

### 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. Interior luminaires.
  - 2. Emergency lighting units.
  - 3. Exit signs.
  - 4. Luminaires supports.

- B. Related Sections:

- 1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

#### 1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CCT: Correlated color temperature
- C. CRI: Color-rendering index.
- D. CU: Coefficient of utilization
- E. LER: Luminaire efficacy rating.
- F. Luminaire: Complete lighting fixture, including ballast housing if provided.
- G. RCR: Room cavity ratio.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of lighting fixture including dimensions.
  - 2. Emergency lighting units including battery and charger.
  - 3. Driver and diodes factor.
  - 4. Energy-efficiency data.

5. Life, output, CCT, CRI, lumens and energy-efficiency data for luminaires.
  6. Photometric data, in IESNA format, based on laboratory tests of each luminaire type, outfitted with accessories identical to those indicated for the luminaires as applied in this Project. Provide conversion factors for all luminaire data if not the same as supplied for this project.
- B. Shop Drawings: For nonstandard or custom luminaires. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  2. Wiring Diagrams: For power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plan(s), drawn to scale, on which luminaires, suspension system, construction that penetrates ceilings or is supported by them and other details are shown. Coordinate the following items, as a minimum, with each other, using input from Installers of the items involved:
1. Lighting fixtures.
  2. Suspended ceiling components.
  3. Structural members to which suspension systems for lighting fixtures will be attached.
  4. Other items in finished ceiling including the following:
    - a. Air outlets and inlets.
    - b. Speakers.
    - c. Sprinklers.
    - d. Smoke and fire detectors.
    - e. Occupancy sensors.
    - f. Access panels.
    - g. Ceiling mounted projectors
    - h. Partitions and millwork that penetrate the ceiling or extends to within one foot of the plane of the luminaires.
  5. Perimeter moldings.
- D. Product Certificates: For each type of ballast for dimmer-controlled fixtures, from manufacturer.
- E. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
- F. Field quality-control reports.
- G. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
- H. Warranties: Sample of special warranties.

## 1.5 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.



- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.
- D. Provide specified manufacturer or approved substitute manufacturer listed in Fixture Schedule.

#### 1.6 COORDINATION

- A. 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. Coordinate the following items, as a minimum, with each other, using input from Installers of the items involved:
  - 1. Lighting fixtures.
  - 2. Suspended ceiling components.
  - 3. Structural members to which suspension systems for lighting fixtures will be attached.
  - 4. Other items in finished ceiling including the following:
    - a. Air outlets and inlets.
    - b. Speakers.
    - c. Sprinklers.
    - d. Smoke and fire detectors.
    - e. Occupancy sensors.
    - f. Access panels.
    - g. Ceiling mounted projectors
    - h. Partitions and millwork that penetrate the ceiling or extends to within one foot of the plane of the luminaires.

#### 1.7 WARRANTY

- A. Special Warranty for Emergency Luminaires Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
  - 2. Completion.
- B. Special Warranty for LED: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
  - 1. Warranty Period: Ten year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In the Luminaire Schedule where titles below are column or row headings that introduce lists or are added in notes for particular luminaire types, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
  2. Basis-of-Design Product: The design for each luminaire is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by another manufacturer equal to the specified. Provide manufacturers data sheets and point-to-point calculations for the substituted luminaires.

### 2.2 LUMINAIRES, GENERAL REQUIREMENTS

- A. Recessed Luminaires: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
1. Aluminum or steel housing; finish as per luminaire schedule on plans
- B. LED Luminaires: Comply with UL 1598. .
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally when secured in operating position.
- F. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
1. White Surfaces: 85 percent.
  2. Specular Surfaces: 83 percent.
  3. Diffusing Specular Surfaces: 75 percent.
  4. Laminated Silver Metallized Film: 90 percent.
- G. Diffusers and Globes:
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.
    - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.
    - b. UV stabilized.
  2. Glass: Annealed crystal glass, unless otherwise indicated.

## 2.3 EXIT SIGNS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
  - 1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
  - 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
    - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    - f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

## 2.4 EMERGENCY LED BATTERY UNITS

- A. Description: Self-contained units complying with UL 924.
  - 1. Battery: Sealed, maintenance-free, lead-acid type.
  - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
  - 3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
  - 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
  - 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
  - 6. Integral Time-Delay Relay: Holds unit on for fixed interval of 10 minutes when power is restored after an outage.
  - 7. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

## PART 3 - PRODUCTS

### 3.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**

### 3.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Recessed Fixtures: Comply with NEMA LE 4.
- C. CRI of minimum 80 ; CCT of 3500 K
- D. Rated lamp life of minimum **50,000** hours.
- E. LED dimmable from 100 percent to 0 percent of maximum light output.
- F. Internal driver.
- G. Nominal Operating Voltage – see Luminaire Schedule on plans.
- H. Housings:

## PART 4 - EXECUTION

### 4.1 INSTALLATION

- A. Luminaires: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Luminaires in or on Grid-Type Suspended Ceilings: Use grid as a support element.
  - 1. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
  - 2. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
  - 3. Install at least two independent support rods or wires from structure to a tab on lighting fixture. Wires or rods shall have breaking strength of the weight of fixture at a safety factor of 3.
- C. Suspended Luminaires Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

- 3. Do not use grid as support for pendant luminaires. Provide support wires or rods connected to building structure.
- D. Adjust aimable luminaires to provide required light intensities.
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

#### 4.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100



## SECTION 265119 – LED INTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Interior solid-state luminaires that use LED technology.
  - 2. Lighting fixture supports.

#### 1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, arranged by designation.
- B. Shop Drawings: For nonstandard or custom luminaires.
  - 1. Include plans, elevations, sections, and mounting and attachment details.
  - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved:
- B. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
- C. Product Certificates: For each type of luminaire.

- D. Sample warranty.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

## 1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Minimum Ten year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**

### 2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. Recessed Fixtures: Comply with NEMA LE 4.
- E. CRI of minimum 80 ; CCT of 3500 K
- F. Rated lamp life of minimum **50,000** hours.
- G. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- H. Internal driver.
- I. Nominal Operating Voltage – see Luminaire Schedule on plans.
- J. Housings:
  - 1. Aluminum or steel housing; finish.as per luminaire schedule on plans



## 2.3 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Division 26 for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, as per manufacturer's specifications.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Aircraft cable shall be 1/8 inch.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports: Sized and rated for luminaire weight.
- E. Flush-Mounted Luminaire Support: Secured to outlet box.
- F. Wall-Mounted Luminaire Support:
  - 1. Attached to structural members in walls.
  - 2. Do not attach luminaires directly to gypsum board.
- G. Ceiling-Mounted Luminaire Support:
  - 1. Ceiling mount with two minimum 5/32-inch diameter aircraft cable supports adjustable to 36 inches.
- H. Suspended Luminaire Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
  - 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and **wire support** for suspension for each unit length of luminaire chassis, including one at each end.
  - 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

- I. Ceiling-Grid-Mounted Luminaires:
  - 1. Secure to any required outlet box.
  - 2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
- J. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26.

### 3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 265119

## SECTION 265600 – EXTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that use LED technology.
2. Luminaire-mounted photoelectric relays.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.
- B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.

#### 1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with IEEE C2, "National Electrical Safety Code."
- C. Comply with NFPA 70.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis of Design: Lithonia WST LED or approved equal.

#### 2.2 GENERAL DESCRIPTION: A die-cast LED trapezoidal wall sconce with a non-pixilated light source for visual comfort. The lumen output of up to 6,500 lumens and an efficacy greater than 120 LPW. When required by Code, the luminaire must be available with two individual drivers paired with two independent light engines which provide the required redundancy.

- A. Construction: The single-piece die-cast aluminum housing integrates secondary heat sinks to optimize thermal transfer from the internal light engine heat sinks and promote long life. The driver is mounted in direct contact with the casting for a low operating temperature and long life. The die-cast door frame is fully gasket with a one-piece solid silicone gasket to keep out moisture and dust, providing an IP65 rating for the luminaire.
- B. Finish: Exterior parts are protected by a zinc-infused Super Durable TGIC thermoset powder coat finish that provides superior resistance to corrosion and weathering. A tightly controlled multi-stage process ensures a minimum 3 mils thickness for a finish that can

withstand extreme climate changes without cracking or peeling. Standard Super Durable colors include dark bronze, black, natural aluminum, sandstone, and white. Available in textured and non-textured finishes.

- C. Optics: Well-crafted reflector optics allow the light engine to be recessed within the luminaire, providing visual comfort, superior distribution, uniformity, and spacing in wall-mount applications.
- D. Electrical: Light engine(s) consist of 98 high-efficacy LEDs mounted to a metal core circuit board and integrated aluminum heat sinks to maximize heat dissipation and promote long life (100,000 hrs at 40°C, L87). Class 2 electronic driver has a power factor >90%, THD <20%. Easily serviceable surge protection device meets a minimum Category B (per ANSI/IEEE C62.41.2).
- E. Installation: A universal mounting plate with integral mounting support arms allows the fixture to hinge down for easy access while making wiring connections.
- F. Listings: CSA certified to U.S. and Canadian standards. The luminaire is IP65 rated. PIR and back box options are rated for wet location. Rated for -30°C to 40°C ambient. DesignLights Consortium® (DLC) Premium qualified product. Not all versions of this product may be DLC Premium qualified. Please check the DLC Qualified Products List at [www.designlights.org/QPL](http://www.designlights.org/QPL) to confirm which versions are qualified.
- G. Warranty: 5-year limited warranty. Complete warranty terms located at [www.acuitybrands.com/CustomerResources/Terms\\_and\\_conditions.aspx](http://www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx).

## 2.01 LED FIXTURES

- A. LED Light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
- B. LED Light fixtures shall be Reduction of Hazardous Substances (RoHS) – compliant.
- C. LED Drives shall include the following features unless otherwise indicated.
  - 1. Minimum efficiency: 85% at full load
  - 2. Minimum Operating Ambient Temperature: -20 degrees C. (14 degrees F.)
  - 3. Input Voltage: 120 – 277V (+-10%) at 60 Hz.
  - 4. Integral short circuit, open circuit, and overload protection.
  - 5. Power Factor: less than or equal to 0.95.
  - 6. Total Harmonic Distortion: less than or equal to 20%.
  - 7. Comply with FCC 47 CFR Part 15.

Fixtures: For fixture types see Lighting Fixture Schedule on drawings.

## 2.3 NOTES

- A. Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.
- B. Sample Nomenclature:
1. Standard: WST LED P1 40K VF MVOLT DDBTXD.
  2. With Redundant Gear: WST LED P1 40K VF MVOLT **DS** DDBTXD.
- C. Key Specifications:

Construction	Die-cast aluminum
Finish	zinc-infused Super Durable TGIC thermoset powder coat
Ingress Protection	IP65
Optics	Non-pixilated source, prismatic glass
Optical Performance	0% up-light and less than 20% back-light
Efficacy	>120 LPW
Lumen Maintenance	>L92 / 50,000 hours
CCT / CRI	2700K, 3000K, 4000K, 5000K; >70 CRI
Controls	Bi-level motion sensor

## PART 3 - EXECUTION

### 3.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Fasten luminaire to indicate structural supports.
1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming.

### 3.2 BOLLARD LUMINAIRE INSTALLATION

- A. Align units for optimum directional alignment of light distribution.
- B. Install on concrete base with top 4 inches above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 3.

### 3.3 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

3.01 INSTALL ON CONCRETE BASE WITH TOP 4 INCHES ABOVE FINISHED GRADE OR SURFACE AT LUMINAIRE LOCATION. CAST CONDUIT INTO BASE, AND FINISH BY TROWELING AND RUBBING SMOOTH. CONCRETE MATERIALS, INSTALLATION, AND FINISHING ARE SPECIFIED IN DIVISION 3.

### 3.02 FIELD QUALITY CONTROL

- A. Inspect installed units for damage.
- B. Provide advance notice of dates and times for field tests. Coordinate with Architect.
- C. Provide instruments to make and record test results.
- D. Tests: Verify normal operation of lighting units after installing fixtures and energizing circuits with normal power source. Include the following:
  - 1. Photometric Tests: Measure light intensities at locations where specific illumination performance is indicated. Use photometers with calibration referenced to NIST standards.
  - 2. Check for excessively noisy ballasts.
  - 3. Check for uniformity of illuminations.
  - 4. Written report of tests indicating actual illumination results.
- E. Replace or repair damaged and malfunctioning units and retest.

### 3.03 ADJUSTING AND CLEANING

- A. Clean components on completion of installation. Use methods and materials recommended by manufacturer.
- B. Adjust aimable fixtures to provide required light intensities.

### 3.4 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Division 26. In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

### 3.5 GROUNDING

- A. Ground metal support structures according to Division 26.
- B. Ground nonmetallic support structures according to Division 26.

END OF SECTION 265600

## SECTION 270000 – COMMUNICATIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY OF WORK

- A. The scope of work specified by these documents shall result in the provision, installation and testing of the following IT Communications infrastructure, systems and equipment.
  - 1. All Voice and Data System Wiring
  - 2. Conduit and raceways. Cable ladders in MDF and IDFs shall be provided by Electrical Contractor
- B. Systems shall utilize digital technology to integrate the following systems into a single network linking them to a central site:
  - 1. LAN System
    - a. For data communications, the existing Wide Area Network will be the central means of communicating throughout for Authority-wide email, network access to shared files and Internet Access.
    - b. Locally, the facility will be provided with wiring for a Local Area Network for all local voice/data and video connectivity.
    - c. Data Network Backbone shall be comprised of 50/125-micrometer, optical fiber cabling.
    - d. Voice Backbone shall be 100 Pair Category 3 UTP cable.
  - 2. Wired Data Communication System consisting of Category 6 horizontal cabling infrastructure.
    - a. Topology
      - 1) The network backbone shall consist of gigabit Ethernet over multi-mode fiber.
      - 2) The horizontal cabling to the desktop from the wiring closets shall consist of Fast Ethernet 100BASE-TX
      - 3) Refer to Division 27 for detailed cabling requirements:
    - b. Quality Assurance
      - 1) All equipment shall be installed in a neat and workmanlike manner.
      - 2) All methods of construction that are not specifically described or indicated in the Contract Documents shall be subject to the control and approval of the Authority's representative.
      - 3) Materials shall be of the quality and manufacturer indicated. Only equipment and materials manufactured by major manufacturing companies are acceptable. No generic equipment or materials shall be allowed, unless otherwise approved in writing by the Design Consultant.
      - 4) Separation from sources of EMI shall be as specified in section.
      - 5) Communication grounding/earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC 1000-5-2, ANSI/TIA/EIA-607, or both be observed throughout the entire cabling system.
      - 6) Materials and work specified herein shall comply with the applicable requirements of:
        - a) EIA/TIA-568-A.
        - b) EIA/TIA-569-A
        - c) EIA/TIA-606

- d) EIA/TIA-607
- e) Underwriters Laboratory
- f) FCC (including CFR 47 and Part 68 - subpart F)
- g) National Electric Code
- h) Local and State Codes
- i) ISO/IEC 11801
- j) IEC 1000-5-2
- k) CSA C22.2
- l) IEC 60603-7

C. These systems shall be integrated by means of an in building Network of cables.

- 1. Cable Infrastructure
  - a. All horizontal technology cabling for the new school will be integrated with the data network, telephone, intercom, and security systems, utilizing Category 6; Fiber Optic and coaxial cables.
- 2. Backbone cabling for data shall utilize laser optimized Fiber Optics cable as specified.
- 3. Cabling for data and telecommunications between the jack plate and either MDF or IDF shall be category 6 (minimum).
- 4. Based on distance limitations from MDF/IDF's to the classroom, the cabling distance standard of 290' for data networks shall be adhered to.
- 5. Backbone cabling for the telephone system shall be multi-pair category 6 UTP sufficient to extend all telephone jacks and shall be run from the MDF/IDF to the Telco DeMarc.
- 6. All wiring will be in conduit.

## 1.2 REGULATIONS AND CODE COMPLIANCE

A. All work and materials shall conform to and be installed, inspected and tested in accordance with the most current governing rules and regulations of federal, state and local governmental agencies.

B. The following is a list of codes and standards that will apply to this project:

- 1. Federal Occupational Safety and Health Administration - OSHA.
- 2. National Life Safety Code, NFPA 101.
- 3. National Electrical Code (NEC), NFPA 70
- 4. Underwriters Laboratory (UL).
- 5. ANSI/TIA/EIA - Telecommunications Building Wiring Standards (Most current addition, revision and addenda), including, but limited to, the following compilation series of documents: 568, 570, 598, 606, 607, 758, TSB 67, TSB 72, TSB 75, FIP 174, FIP175, FIP176,
- 6. BICSI Telecommunications Distribution Methods Manual, Telecommunications Cabling Installation Manual, Customer-Owned Outside Plant Manual, LAN and Internetworking Design Manual.
- 7. IEEE Standards.
- 8. IEEE-SA - National Electrical Safety Code (NESC)
- 9. Federal Communications Commission.
- 10. NEMA – National Electrical Manufacturers' Association
- 11. CSA – Canadian Standards Association
- 12. ADA, Americans with Disabilities Act.

## 1.3 GLOSSARY



- A. ANSI: American National Standards Institute
- B. ASME: American Society of Mechanical Engineers
- C. ASTM: American Society for Testing Materials
- D. BICSI: Building Industry Consulting Services International
- E. CSA: Canadian Standards Association
- F. EIA: Electronic Industries Association
- G. FCC: Federal Communications Commission
- H. FM: Factory Mutual Insurance Company
- I. IEEE: Institute of Electrical and Electronics Engineers
- J. IRI: Industrial Risk Insurers
- K. ISO: International Standards Organization
- L. NEC: National Electrical Code
- M. NEMA: National Electrical Manufacturers' Association
- N. NESC: National Electrical Safety Code
- O. NFPA: National Fire Protection Association
- P. New York BFU: New York Board of Fire Underwriters
- Q. New York /DEC: New York Department of Environmental Conservation
- R. New York /UFBC: New York Uniform Fire Prevention and Building Code
- S. OSHA: Occupational Safety and Health Administration
- T. TIA: Telecommunications Industry Association
- U. UFPO: Underground Facilities Protective Organization
- V. UL: Underwriter's Laboratories, Inc.

#### 1.4 DEFINITIONS

- A. Approved / Approval: Written permission to use a material or system.
- B. As Called For: Materials, equipment including the execution specified/shown in the contract documents.
- C. Code Requirements: Minimum requirements.
- D. Concealed: Work installed in pipe and duct shafts, chases or recesses, inside walls, above

ceilings, in slabs or below grade.

- E. Design Equipment: Refer to the article, BASIS OF DESIGN.
- F. Design Make: Refer to the Article, BASIS OF DESIGN.
- G. Equal or Equivalent: Equally acceptable as determined by Design Consultant.
- H. Exposed: Work not identified as concealed.
- I. Final Acceptance: The Authority's acceptance of the project from Contractor upon certified by the Authority's Representative.
- J. Furnish: Supply and deliver to installation location.
- K. Furnished by Others: Receive delivery at job site or where called for and installed.
- L. Inspection: Visual observations by the Authority's site Representative.
- M. Install: Mount and connect equipment and associated materials ready for use.
- N. Labeled: Refers to classification by a standards agency.
- O. Make: Refer to the article, BASIS OF DESIGN.
- P. Or Approved Equal: Approved equal or equivalent as determined by Design Consultant.
- Q. Authority's Representative: The Prime Professional
- R. Prime Professional: Design Consultant having a contract directly with the Authority for professional services.
- S. Provide: Furnish, install and connect ready for use.
- T. Relocate: Disassemble, disconnect, and transport equipment to new locations, then clean, test, and install ready for use.
- U. Replace: Remove and provide new item.
- V. Review: A general contractual conformance check of specified products.
- W. Roughing: Pipe, duct, conduit, cabling, equipment layout and installation.
- X. Satisfactory: As specified in contract documents.
- Y. Site Representative: Construction Manager at the work site.
- Z. Refer to General Conditions of the Contract for additional definitions.

#### 1.5 INTENT OF DRAWINGS

- A. The drawings are diagrammatic, unless detailed dimensioned drawings are included. Drawings show approximate locations of equipment, and fixtures. Exact locations are subject to the approval of the Authority's Representative.

- B. The Contractor should verify all dimensions locating the work and its relation to existing work, all existing conditions and their relation to the work and all man made obstructions and conditions, etc. affecting the completion and proper execution of the work as indicated in the Contract Documents.

## PART 2 – PRODUCTS

### 2.1 Equipment and Materials Minimum requirements:

#### A. Materials requirements:

1. All equipment and material for which there is a listing service shall bear a UL label.
2. Electrical equipment and systems shall meet UL Standards and requirements of the NEC and CSA. This listing requirement applies to the entire assembly. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.
3. Equipment shall meet all applicable FCC Regulations
4. All materials, unless otherwise specified, shall be new and be the standard products of the manufacturer. Used equipment or damaged material will be rejected.
5. The listing of a manufacturer as “acceptable” does not indicate acceptance of a standard or catalogued item of equipment. All equipment and systems must conform to the Specifications and meet the quality of the design make.
6. Where applicable, all materials and equipment shall bear the label and listing of Underwriters Laboratory of Factory Mutual. Application and installation of all equipment and materials shall be in accordance with such labeling and listing.

### 2.2 CABLES

- A. Any cable associated with this Contract, passing through two or more floors shall be suitable, listed and marked for use in a riser or plenum application. Riser cable shall minimally be CMR or OFNR rated per the National Electrical Code and shall meet all local and state codes.
- B. Any cable associated with this Contract shall be rated, listed and marked for use in a plenum application, regardless if the ceiling is a ducted return air plenum or not. Cable shall meet all local and state codes.
- C. Voice copper backbone cables, if required, shall be twisted 24 AWG, contain a corrugated aluminum shield, be of the size indicated on the drawings and have the proper jacket classification per the NEC.
- D. All copper underground feeder cable associated with this Contract, if required, shall be suitable, listed and marked for use in a duct application per the National Electrical Code article 800 and shall meet all local codes. Copper underground cables shall be jell-filled, twisted 24 AWG., contain a overall corrugated shield, be of the size indicated on the drawings, shall have footage indicators imprinted on the cable jacket and shall meet REA/RUS specification PE-39 or PE-89.

### 2.3 FACTORY ASSEMBLED PRODUCTS

- A. Provide maximum standardization of components to reduce spare part requirements.
- B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.
  2. Constituent parts, which are alike, shall be product of a single manufacturer.
  3. Components shall be compatible with each other and with the total assembly for intended service.
- C. Components of equipment shall bear manufacturer's name or trademark, model number and serial number on a nameplate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- D. Major items of equipment that serve the same function must be the same make and model. Exception will be permitted if performance requirements cannot be met.

#### 2.4 COMPATABILITY OF RELATED EQUIPMENT

- A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that a complete and fully operational system will result.
- B. Provide maximum standardization of components to reduce spare part requirements.
- C. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.
1. All components of an assembled unit need not be products of same manufacturer.
  2. Constituent parts that are alike shall be product of a single manufacturer.
  3. Components of equipment shall bear manufacturer's name or trademark, model number and serial number on a nameplate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

#### 2.5 LIFTING ATTACHMENTS

- A. Equipment should have suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered without bending or distortion of shape, such as rapid lowering and braking of load.

#### 2.6 MISCELLANEOUS SUPPORTS

- A. Metal bars, plates, tubing, etc. shall conform to the following ASTM standards:
1. Steel plates, shapes, bars, and grating - ASTM A 36
  2. Cold-Formed Steel Tubing - ASTM A 500
  3. Hot - Rolled Steel Tubing - ASTM A 500
  4. Steel Pipe - ASTM A 53, Schedule 40, welded
- B. Metal Fasteners shall be Zinc-coated (type, grade and class as required)

#### 2.7 FIRESTOPPING

- A. Firestopping for Openings through Fire and Smoke Rated Walls and Floor Assemblies shall be listed or classified by an approved independent testing laboratory for "Through-Penetration Firestop Systems." The system shall meet the requirements of "Fire Tests of Through-Penetration Firestops" designated ASTM E814.

- B. Inside of all conduits, the firestop system shall consist of a dielectric, water resistant, non-hardening, permanently pliable/re-enterable putty along with the appropriate damming or backer materials (where required). The sealant must be capable of being removed and reinstalled and must adhere to all penetrants and common construction materials and shall be capable of allowing normal wire/cable movement without being displaced.
- C. All conduit and sleeve openings shall be waterproofed or fireproofed in compliance with New York Building and Fire Codes. Strict adherence to National and State Fire Codes, particularly firestopping will be required.
- D. All openings remaining around and inside all conduit, sleeves and cable penetrations to maintain the integrity of any fire rated wall, ceiling, floor, etc. shall be patched.
- E. All building conduits and sleeves installed and/or used under this contract shall be firestopped or re-firestopped upon cable placement through such passageways.
- F. Manufacturer's recommended installation standards must be closely followed (i.e. minimum depth of material, use of ceramic fiber and installation procedures).
- G. Provide firestop system seals at all locations where conduit, fiber, cable trays, cables/wires, and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide firestop seal between sleeve and wall for drywall construction.
- H. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the firestop system. The installation shall provide an air and watertight seal.
- I. The methods used shall incorporate qualities that permit the easy removal or addition of conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating. Typical rating:
  - 1. Floors - 3 hours
  - 2. Corridor walls - 2 hours
  - 3. Offices -  $\frac{3}{4}$  hour
  - 4. Smoke partitions -  $\frac{3}{4}$  - 1 hour
- J. Provide firestop pillows for existing cable tray penetrations through firewalls.

### PART 3 - EXECUTION

#### 3.1 ROUGH-IN

- A. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, etc. Verify final locations for installation with field measurements and with the equipment being connected. Verify exact location and elevations at work site prior to any rough in work. If field conditions, details, changes in equipment or shop drawing information require a significant change to the original documents, contact the Authority's representative for approval before proceeding.
- B. All equipment locations shall be coordinated with other trades, other renovation projects, and existing conditions to eliminate interference with required clearances for equipment maintenance and inspection.

1. Coordinate work with other trades, other renovation projects, and existing conditions to determine exact routing of all cable tray, hangers, conduit, etc., before fabrication and installation. Coordinate with Technology Drawings. Verify with the Authority's Representative exact location and mounting height of all equipment in finished areas, such as equipment racks, communication and electrical devices. Coordinate all work with existing architecture.
  2. Where more than one trade is involved in an area, space or chase, all shall cooperate and install their own work to utilize the space equally between them in proportion to their individual requirements. There will be no priority schedule for trades. If, after installation of any equipment, piping, ducts, conduit, and boxes, it is determined that ample maintenance and passage space has not been provided, rearrange work and/or furnish other equipment as required for ample maintenance space. Any changes in the size or location of the material or equipment supplied or proposed, which may be necessary in order to meet field conditions or in order to avoid conflicts between trades, shall be brought to the immediate attention of the Authority's Representative and approval received before such alterations are made.
- C. Provide easy, safe, and code mandated clearances at equipment racks and enclosures, and other equipment requiring maintenance and operation.

### 3.2 CUTTING AND PATCHING

- A. Cut and drill from both sides of walls and/or floors to eliminate splaying. Patch adjacent existing work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering, other finished surfaces. Patch and/or paint openings and damaged areas equal to existing surface finish. Cut openings in prefabricated construction units in accordance with manufacturer's instructions.

### 3.3 CONCEALMENT

- A. Use existing conduit and surface raceway where possible and practicable. Conceal all contract work above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify the Authority's Representative before starting that part of the work and install only after his review. In areas with no ceilings, install only after the Authority's Representative reviews and comments on arrangement and appearance.

### 3.4 CHASES

#### A. General

1. Field verifies for correct size and location for all openings, recesses and chase.
2. Assume responsibility for correct and final location and size of such openings.
3. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.
4. Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Cap or firestop all unused conduits and sleeves.
5. Provide angle iron frame where openings are required for contract work.
6. Seal voids in fire rated assemblies with a firestopping seal system to maintain the fire resistance of the assembly. Provide 18 gauge-galvanized sleeves at fire rated assemblies. Extend sleeves 2" above floors.
7. In wall openings, drill or cut holes to suit. Provide 18 gauge galvanized sleeves at shafts and fire rated assemblies. Provide firestopping seal between sleeves and wall in drywall construction. Provide firestopping similar to that for floor openings.

### 3.5 WATERPROOFING

- A. The Contractor shall seal all foundation penetrating conduits and all service entrance conduits and sleeves to eliminate the intrusion of moisture and gases into the building. This requirement also includes spare conduits.
- B. Spare conduits shall be plugged with expandable plugs.
- C. All service entrance conduits through building shall be sealed or resealed upon cable placement.
- D. Conduits with cables in them shall be permanently sealed by firmly packing the void around the cable with oakum and capping with a hydraulic cement or waterproof duct seal.

### 3.6 SUPPORTS

- A. Provide required supports, beams, angles, hangers, rods, bases, braces, straps, struts, and other items to properly support contract work. Supports shall meet the approval of the the Authority's Representative. Modify studs, add studs, add framing, or otherwise reinforce studs in metal stud walls and partitions as required to suit contract work. If necessary, in stud walls, provide special supports from floor to structure above. For precast Panels/Planks and Metal Decks, support communication work as determined by manufacturer and the Authority's Representative. Provide heavy gauge steel mounting plates for mounting contract work. Mounting plates shall span two or more studs. Size, gauge, and strength of mounting plates shall be sufficient for equipment size, weight, and desired rigidity.

### 3.7 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate ordering and installation of all equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.
- B. Where mounting heights are not detailed or dimensioned, install systems, materials and equipment to provide the maximum headroom possible.
- C. Set all equipment to accurate line and grade, level all equipment and align all equipment components.
- D. Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment and apparatus furnished into the premises. These items shall be removed from premises when no longer required.
- E. No equipment shall be hidden or covered up prior to inspection by the Authority's representative. All work that is determined to be unsatisfactory shall be corrected immediately.
- F. All work shall be installed level and plumb, parallel and perpendicular to other building systems and components.

### 3.8 IMPLEMENTATION

- A. The contractor shall provide and install all hardware, software, connections and appurtenances required for fully operational systems.

END OF SECTION 270000





## SECTION 270500 – COMMON WORK RESULTS FOR COMMUNICATIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Sleeves for pathways and cables.
2. Sleeve seals.
3. Grout.
4. Common communications installation requirements.

#### 1.2 SUBMITTALS

##### A. Product Data: For sleeve seals.

##### B. Warranty: Provide manufacturer's system warranty against electrical or mechanical defects for 2 years from date of final acceptance.

### PART 2 - PRODUCTS

#### 2.1 TELE-POWER POLES

##### A. Acceptable Manufacturers:

1. Mono-Systems, Inc.
2. Panduit Corp.
3. Wiremold/Legrand
4. Or approved equal

##### B. Material: Aluminum with clear anodized finish.

##### C. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

#### 2.2 SLEEVES FOR PATHWAYS AND CABLES

##### A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

##### B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

##### C. Sleeves for Rectangular Openings: Galvanized sheet steel.

##### 1. Minimum Metal Thickness:

- a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
- b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

## 2.3 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.
  - 1. Acceptable Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
    - e. Or approved equal
  - 2. Sealing Elements: Interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.
  - 3. Pressure Plates: Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## PART 3 - EXECUTION

### 3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

### 3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Utilize 4" sleeves to provide clear space between sleeve and pathway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
  - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 7.
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Division 7.
- K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

### 3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7.

END OF SECTION 270500



## SECTION 270526 – GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

### PART 1 – GENERAL

#### 1.1 WORK INCLUDED

- A. Provide all labor, materials, tools, installation equipment, and test equipment required for the complete installation of grounding and bonding for telecommunications systems within the structure.

#### 1.2 REFERENCES

- A. ANSI-J-STD-607-A-2002 – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
- B. National Fire Protection Association (NFPA – 70), National Electrical Code (NEC)
- C. ANSI T1.333-2001 – Grounding and Bonding of Telecommunications Equipment

#### 1.3 QUALITY ASSURANCE

- A. The materials and their installation shall conform to the requirements of ANSI-J-STD-607-A-2002 and the National Electrical Code
- B. Use adequate numbers of skilled work-persons thoroughly trained and experienced on the necessary crafts and completely familiar with the specified requirements and methods needed for the proper performance of the work of this Section.

### PART 2 – PRODUCTS

#### 2.1 STANDARD

- A. All materials used in the installation shall be new and shall comply in weight, size and composition as required by manufacturer and shall be labeled or listed by Underwriters Laboratories Inc. for use in electrical grounding.

#### 2.2 ACCEPTABLE MANUFACTURES

- 1. Harger Lightning & Grounding
- 2. Or Approved Equal

#### 2.3 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

- A. The TMGB shall be ¼”T x 4”W x 12”L copper ground bar.
  - 1. The TMGB shall be predrilled with holes for use with standard sized lugs.
  - 2. The TMGB shall be UL listed and meet the requirements of ANSI-J-STD-607-A-2002
  - 3. The TMGB shall be sized as above or lengthened to meet requirements of the immediate application with consideration for future growth.

## 2.4 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

- A. The TGB shall be a ¼”T x 2”W x 12”L copper ground bar.
  - 1. The TMGB shall be predrilled with holes for use with standard sized lugs.
  - 2. The TMGB shall be UL listed and meet the requirements of ANSI-J-STD-607-A-2002.
  - 3. The TMGB shall be sized as above or lengthened to meet requirements of the immediate application with consideration for future growth.

## 2.5 CONDUCTORS

- A. Conductors shall be stranded copper conductors with green insulation
  - 1. Minimum conductor size No. 6 AWG.
  - 2. Conductors shall be sized at 2 kcmil per linear foot of conductor length. For example: A conductor 25 feet in length shall be No. 2 AWG (66,360 cmil). A conductor 100 feet in length shall be No. 4/0 AWG (211,600 cmil)
  - 3. Insulation shall be rated for the environment where it is installed.

## 2.6 CONNECTOR LUGS

- A. Lugs for connecting to the TMGB and TGB shall be UL Listed two-hole, long barrel, electro tin-plated compression lugs with inspection port.
  - 1. Antioxidant joint compound shall be applied to the contact areas.
  - 2. Lugs shall be secured to the ground bars with ¼” minimum stainless steel hex head cap screws with stainless steel washers, lock washers and nuts.

## 2.7 EXOTHERMIC WELDED CONNECTIONS

- A. Exothermic Welded connections shall be.
  - 1. Weld types BE shall be made to the ground bars using appropriate size weld metal.
  - 2. Weld types VA, VD, or VU shall be made to structural steel framework

# PART 3 – EXECUTION

## 3.1 INSTALLATION

- A. The telecommunications main grounding bar (TMGB) is a dedicated extension of the building grounding electrode system for the telecommunications system. The TMGB should be located near the telecommunications service entrance and the electric service entrance.
  - 1. The TMGB shall be connected to the main electric service entrance panel ground or the branch electric panel ground that serves the telecommunications equipment.
  - 2. The TMGB shall be located to minimize the length of the bonding conductor for telecommunications from the TMGB to the electric service ground.
  - 3. The bonding conductor for telecommunications shall be at least the same size as the telecommunications backbone (TBB) conductor.
  - 4. The TMGB shall serve telecommunications equipment that is located in the same room or space.
  - 5. Connections to the TMGB shall be made by exothermic welding or by listed two-hole

- compression lugs.
6. All metal conduits or raceways for telecommunications cabling located within the same room or space as the TMGB shall be bonded to the TMGB.
    - a. Metal conduits 1" diameter and larger shall be bonded using electro tin-plated pipe clamps.
    - b. Metal conduits less than 1" diameter shall be bonded using electro tin-plated conduit bonding clamps.
    - c. Metal cable trays shall be bonded using electro tin-plated cable tray bonding clamps.
    - d. Bonding surface areas shall be cleaned to bare metal removing all paint, etc. The contact area shall be protected from corrosion using antioxidant joint compound.
  7. Where an electric power panel for telecommunications equipment is located in the same room or space as the TMGB, the panel ground bus or panel enclosure shall be bonded to the TMGB.
  8. The TMGB shall be located in an area that is accessible to telecommunications personnel
- B. The telecommunications backbone (TBB) is a conductor that originates at the TMGB and extends throughout the building interconnecting all telecommunications grounding busbars (TGBs) with the TMGB.
1. The TBB shall be a copper conductor. The minimum size of the conductor shall be No. 6 AWG. The size of the conductor shall be increased 2 kcmil per linear foot as the length of the TBB increases. For example: A TBB 25 feet in length shall be No. 2 AWG (66,360 cmil). A TBB 100 feet in length shall be No. 4/0 AWG (211,600 cmil)
  2. The TBB conductors should be installed without splices. Where splices are necessary, the number of splices should be minimized and located in accessible telecommunications spaces. Splices shall be made using exothermic welding, listed irreversible compression connectors or equivalent.
  3. The building water piping system shall not be used as a TBB.
  4. Metallic cable shields or metallic conduits shall not be used as a TBB.
- C. A telecommunications grounding busbar (TGB) shall be provided in each area where telecommunications equipment is located. The TGB is the grounding connection point for telecommunications systems and equipment in each separate area.
1. The TGBs shall be connected to the TMGB via the TBB conductor.
  2. The TBB and other TGBs within the same area shall be bonded to the TGB with a conductor the same size as the TBB.
  3. The bonding conductor between the TBB and the TGB shall be continuous and routed in the shortest straight-line path possible.
  4. Connections to the TGB shall be made by exothermic welding or by listed two-hole compression lugs.
  5. All metal conduits or raceways for telecommunications cabling located within the same room or space as the TGB shall be bonded to the TGB.
  6. Where an electric power panel for telecommunications equipment is located in the same room or space as the TGB, the panel ground bus or panel enclosure shall be bonded to the TGB.

- D. Where there are multiple telecommunications rooms or spaces with multiple TBBs, the TBBs shall be interconnected with a Grounding Equalizer (GE) conductor at the TGBs.
  - 1. Welding.
  - 2. In structural steel frame buildings, where the steel framework is accessible The GE shall be sized as specified for the TBB.
- E. Connections of the GE to the TGBs shall be made by exothermic within the room; the TMGB and each TGB shall be bonded to the structural steel frame using a minimum No. 6 AWG conductor.
  - 1. Connections to the structural steel frame shall be made by exothermic welding. The area of contact on the steel frame shall be cleaned to bare metal removing all paint and mill scale. The contact area shall be protected from corrosion using antioxidant joint compound.
  - 2. Where the structural steel frame is external to the room and is accessible, the structural steel should be bonded to the TGB or the TMGB using a minimum No. 6 AWG conductor.

END OF SECTION 270526



## SECTION 270528 – PATHWAYS FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 SCOPE OF SPECIFICATION

- A. This section includes the minimum requirements for the following: EMT conduit J-Hooks Threaded Rod Cover Stackable Cable Rack Spacers Cable Management Wireless Access Boxes Fire Stopping Materials Floor Boxes.

#### 1.2 SUBMITTALS

- A. As-Built Drawings

#### 1.3 QUALITY ASSURANCE

- A. All installation work for the interior telecommunications pathways shall be performed in a neat and workmanlike manner.
- B. Equipment and materials shall be of the quality and manufactures indicated. The equipment specified is based on the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified.
- C. Materials and work specified herein shall comply with the applicable requirements of:
  - 1. ANSI/NFPA 70 – National Electrical Code including; but not limited to, the following articles:
    - a. 250 – Grounding
    - b. 300 – Wiring Methods
    - c. 314 – Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings; and Manholes
    - d. 358 – Electrical Metallic Tubing: Type EMT
    - e. 386 – Surface Metal Raceways
    - f. 770 – Optical Fiber Cables and Raceways
  - 2. ANSI/TIA/EIA-568-B.1 – Commercial Building Telecommunications Cabling Standard – Part 1: General Requirements, including applicable addendum
  - 3. ANSI/TIA/EIA-569-A – Commercial Building Standard for Telecommunications Pathways and Spaces, including applicable addendum
  - 4. ANSI/TIA/EA-606 – Administration Standard for Telecommunications Infrastructure of Commercial Buildings
  - 5. ANSI/TIA/EIA-607 – Commercial Building Grounding and Bonding Requirements for Telecommunications
  - 6. BICSI Telecommunications Distribution Methods Manual

#### 1.4 FUNCTIONAL SYSTEM DESCRIPTION

- A. Refer to scaled Technology (T) drawings for lengths of cable runs.

### PART 2 - PRODUCTS

#### 2.1 EMT CONDUIT AND OUTLET BOXES

A. Electrical Metallic Tubing (EMT)

1. Electro-galvanized steel tubing 1 1/4" and larger diameter per project requirements: Conduit joint couplings and connectors: steel double set screw indenter fittings, metal bushings for 1 1/4" conduit, insulated metallic bushings for 1-1/4" and larger conduit, insulated metallic bushings with grounding lugs as required.
2. Conduit sweeps: minimum 10 times the conduit inside diameter.
3. Include required conduit straps, and hangers, heavy-duty malleable iron or steel, perforated pipe strap, j-hooks, bridle rings, or wire hangers are not permitted.
4. LB fittings and plastic fittings are not permitted
5. Nipple runs from one outlet box to another outlet box are not permitted.

B. Outlet boxes: Galvanized steel sheet metal 2" x 4" x 2-1/8" deep minimum with single gang mud ring, except for Teacher's Jack.

1. Teacher's Outlet boxes: This requires one (1) 4" x 4" gang boxes at each Teacher's Outlet location.

C. Pull-boxes: Minimum 14 gauge galvanized steel with screw fastened cover and trim for flush or surface mounting as required for the project. Dimensions as required for the project.

D. Metal Flex Conduit (1 1/4") and deep Cut-In Boxes where required.

E. Pull-rope: Polypropylene monofilament line with a minimum pull tensile strength of 200 pounds.

F. Labels for conduit and pull-boxes: 1" x 2" yellow background with 3/8" lettering to read "TELECOM"

## 2.2 NON-CONTINUOUS CABLE SUPPORT (J-HOOKS) SYSTEMS

A. Construction:

1. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed.
2. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
3. Non-continuous cable supports sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.
4. Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.
5. Stainless steel non-continuous cable supports are intended for indoor and outdoor use in non-corrosive environments or where only mildly corrosive conditions apply.

B. Multi-Tiered Non-Continuous Cable Supports Assemblies:

1. Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies may be factory assembled or assembled from pre-packaged kits.
2. Assemblies shall consist of a steel angled hanger bracket holding up to six non-continuous cable supports, rated for indoor use in non-corrosive environments; cULus Listed.
3. If required, the multi-tier support bracket may be assembled to manufacturer

recommended specialty fasteners including beam clamps, flange clips, C and Z purlin clips.

C. Non-Continuous Cable Support Assemblies from Beam, Flange:

1. Fastener to C to Z purlin with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.

D. Non-Continuous Cable Support Assemblies from C & Z Purlin:

1. Fastener to C to Z purlin with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, cULus Listed.

E. Non-Continuous Cable Support Assemblies from Wall, Concrete, or Joist

1. Fastener to wall, concrete, or joist with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments, cULus Listed.

F. Non-Continuous Cable Support Assemblies from Threaded Rod:

1. Fastener to threaded rod with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments, cULus Listed.
2. The multi-tiered support bracket shall have a static load limit of 300 lbs.

G. Installation Accessories for Non-Continuous Cable Supports

1. Non-continuous cable supports may be used as an installation tool when a removable pulley assembly is included.
2. The pulley shall be made of plastic and be without sharp edges.
3. The pin and bail assembly must be able to be secured to the J-Hook during cable installation.
4. The pulley must remain secured while cables are being pulled.
5. The pin and roller assembly must be removed after cables are installed.

## 2.3 WIRELESS ACCESS BOXES

A. Wall-mounted enclosure for Wireless Access Equipment-Gymnasium

1. Vented Steel enclosure 11" x 8" x 3"
2. Finish matching wall plates
3. Continuous hinge swing door with keyed lock
4. Knockouts for cable entry/exit
5. Two 1" antenna openings 5" apart on top of enclosure
6. Include components and compatible fittings from the manufacturer as required for a complete installation

B. Ceiling Enclosure for Wireless Access Equipment – classrooms and hallways

1. Plenum-rated enclosure
2. Mounts in standard 2' x 2' or 2' x 4' ceiling tile
3. Continuous hinge swing down door with keyed lock
4. Cable entry/exit opening with approved fire-rating foam kits
5. Two 1" antenna openings 5" apart on bottom of enclosure
6. Include components and compatible fittings from the manufacturer as required for a

complete installation.

## 2.4 FLOOR BOXES

### A. Acceptable Manufacturers:

1. Legrand
2. Wiremold
3. Or Approved Equal

### B. Floor Boxes

1. Classification and Use: Floor boxes shall have been examined and tested by Underwriters Laboratories Inc. to meet UL514A and/or UL514C and Canadian Standard C22.2, No. 18.1-04 and 18.2-06 and bear the U.S. and Canadian UL Listing Mark. Floor boxes shall also have been tested by Underwriters Laboratories Inc. and classified for fire resistance and bear the U.S. and Canadian UL Classification Mark. Devices shall be classified for use in 2-hour rated, unprotected reinforced concrete floors and 2-hour rated floors employing unprotected steel floor units and concrete toppings (D900 Series Designs) or concrete floors with suspended ceilings (fire resistive designs with suspended ceilings should have provisions for accessibility in the ceiling below the floor boxes). Floor boxes shall also conform to the standards set in Section 300-21 of the National Electrical Code. Floor boxes shall meet UL scrub water requirements, but are not suitable for wet or damp locations, or other areas subject to saturation with water or other liquids such as commercial kitchens. Floor boxes shall also have been evaluated by UL to meet the applicable U.S. and Canadian safety standards for scrub water exclusion when used on tile, bare concrete, terrazzo, wood, and carpet covered floors. Floor boxes shall be suitable for use in air handling spaces in accordance with Section 300-22 (C) of the National Electrical Code.
2. Floor Boxes, General: Evolution Series Floor Boxes for use on above grade concrete floors, raised floors or wood floors. Provide boxes with a component to permit installation in polished concrete or terrazzo floors. Boxes shall be compatible with complete line of workstation connectivity outlets and modular inserts.
  - a. Floor boxes provide the interface between power, communication and audio/video (A/V) cabling in above-grade floors, on-grade concrete floors, raised floors, wood floors, and fire-classified floors and the workstation or activation location where power and communication and/or A/V device outlets are required. Boxes shall provide recessed device outlets that will not obstruct the floor area. Refer to Drawings for size and types.
  - b. Floor boxes shall permit all wiring to be completed at floor level. The FC models shall be used as defined by the UL Fire Resistance Directory at a minimum spacing of two (2) ft [610mm] on center.

### C. The following model floor boxes shall be used according to the appropriate connector density and architectural application.

1. Model EFB6S Floor Boxes: Manufactured from stamped steel approved for use on above grade concrete floors, raised floors and wood floors with the same product. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall have a polyester based backed enamel finished interior (white). Boxes shall be 15-3/16" L x 13-7/8" W x 4-3/16" H [385mm x 351mm x 107mm]. Provide boxes with provisions that enable

installation into concrete floors, raised floors, or wood floors without having to purchase additional components or accessories. Provide boxes with six (6) independent wiring compartments that allow for up to six (6) receptacles, communication and/or audio/video services. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 32-in<sup>3</sup> [524ml]. Each of the two (2) center compartments shall have a minimum wiring capacity of 38.5-in<sup>3</sup> [630ml]. Each of the six (6) compartments shall have a minimum depth of 3-7/8" [98mm] behind the plate. Provide boxes with removable compartments to facilitate installation and moves, additions, and changes. The compartments shall be removable from the top and back of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. Provide boxes with removable knockout plates to allow for the maximum cable pass-through area. The cable pass-through area shall be a minimum of 6-15/16 in<sup>2</sup> [176mm<sup>2</sup>]. The box shall contain the following number of knockouts: 10 1" trade size, six (6) 1-1/4" trade size, six (6) 3/4" trade size, and two (2) 2" trade size. Boxes shall be able to accept up to (6) six 2" trade size conduit feeds in the sides of the boxes, through the use of the EFB6S-2HUB and maintain a 4-inch deep concrete pour. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. Equip boxes with toggle clamps to allow box to be secured to raised and wood floors. The box shall be able to accept 2-3/4" x 4-1/2" standard size wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles, workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

2. Model EFB6S-OG Floor Boxes: Manufactured from stamped steel approved for use in above grade and on-grade floor applications. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall be painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete, and be approved for use on-grade and above grade floors. Boxes shall be 15-3/16" L x 13-7/8" W x 4-3/16" H [385mm x 351mm x 107mm]. Provide boxes with six (6) independent wiring compartments that allow for up to six (6) duplex receptacles, communication and/or audio/video services. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 32-in<sup>3</sup> [524ml]. Each of the two (2) center compartments shall have a minimum wiring capacity of 38.5-in<sup>3</sup> [630ml]. Each of the six (6) compartments shall have a minimum depth of 3-7/8" [98mm] behind the plate.

Provide boxes with removable compartments to facilitate installation. The compartments shall be removable from the top of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. The box shall contain the following number of knockouts: 10 1" trade size, six (6) 1-1/4" trade size, six (6) 3/4" trade size, and two (2) 2" trade size. Boxes shall be able to accept up to (6) six 2" trade size conduit feeds in the sides of the boxes, through the use of the EFB6S-2HUB and maintain a 4-inch deep concrete pour. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. The box shall be able to accept 2-3/4" x 4-1/2" standard size wall plates. Include mounting brackets with the boxes that will accommodate 15 amp,

20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles, workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

3. Model EFB6S-FC Floor Boxes: Manufactured from stamped steel approved for use in 2-hour fire-rated concrete floors. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall have a polyester based backed enamel finished interior (white). Boxes shall be 15-3/16" L x 13-7/8" W x 4-3/16" H [385mm x 351mm x 107mm]. Provide boxes with a 21-3/4" L x 17-1/4" W x 6-1/2" H [552mm x 438mm x 165mm] sheet metal concrete pan to ensure that 3-1/4 inches [83mm] of concrete surrounds the box. Provide boxes with six (6) independent wiring compartments that allow for up to six (6) receptacles, communication and/or audio/video services.

Boxes shall permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 32-in<sup>3</sup> [524ml]. Each of the two (2) center compartments shall have a minimum wiring capacity of 38.5-in<sup>3</sup> [630ml]. Each of the six (6) compartments shall have a minimum depth of 3-7/8" [98mm] behind the plate. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. Provide boxes with four (4) intumescent services feed stems with a 1-1/4-inch [32mm] pass-through channel that allows the pathway to close off during a fire. Boxes shall be fully adjustable, accommodating a maximum 2-1/2-inch [64mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. The box shall be able to accept 2-3/4" x 4-1/2" standard size wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles, workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

4. Model EFB8S Floor Boxes: Manufactured from stamped steel approved for use on above grade concrete floors, raised floors and wood floors with the same product. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall have a polyester based backed enamel finished interior (white). Boxes shall be 15-3/16" L x 12-3/4" W x 6-1/16" H. Provide boxes with provisions that enable installation into concrete floors, raised floors, or wood floors without having to purchase additional components or accessories. Provide boxes with eight (8) independent wiring compartments that allow for up to eight (8) receptacles, communication and/or audio/video services. Boxes shall accept standard size single gang (2-3/4" x 4-1/2"), double gang (4-9/16" x 4-1/2"), and triple gang (6-3/8" x 4-1/2") wall plates. Boxes shall permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 28-in<sup>3</sup>. Each of the four (4) center compartments shall have a minimum wiring capacity of 34-in<sup>3</sup>. Each of the eight (8) compartments shall have a minimum depth of 3- 1/2" [89mm] behind the plate. Provide boxes with removable compartments to facilitate installation and moves, additions, and changes. The compartments shall be removable from the top and back of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. Provide boxes with removable knockout plates to allow for the maximum cable pass-through area. The cable pass-through area shall be a minimum of 11-5/8 in<sup>2</sup>. The box shall contain the following number of knockouts: four (4) 3/4-inch trade size, eight (8) 1-inch trade size, six (6) 1-1/4-inch trade size, and two (2) 2-inch trade size. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a



maximum 1/2" post-concrete pour adjustment. Equip boxes with toggle clamps to allow box to be secured to raised and wood floors. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles. Boxes shall have the ability to accommodate a bracket (EFB-50A) allowing for one (1) 50-amp receptacle. Boxes shall also accommodate workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

5. Model EFB8S-OG Floor Boxes: Manufactured from stamped steel approved for use in above grade and on-grade floor applications. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall be painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete, and be approved for use on-grade and above grade floors. Boxes shall be 15-3/16" L x 12-5/8" W x 6-1/16" H [385mm x 321mm x 154mm]. Provide boxes with eight (8) independent wiring compartments that allow for up to eight (8) duplex receptacles, communication and/or audio/video services. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 28-in3 [455ml]. Each of the four (4) center compartments shall have a minimum wiring capacity of 34-in3 [455ml]. Each of the eight (8) compartments shall have a minimum depth of 3- 1/2" [89mm] behind the plate. Provide boxes with removable compartments to facilitate installation. The compartments shall be removable from the top of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. The box shall contain the following number of knockouts: 12 1-inch trade size, six (6) 1-1/4-inch trade size, and four (4) 2-inch trade size. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. The box shall be able to accept standard size single gang (2-3/4" x 4-1/2"), double gang (2-3/4" x 4- 1/2"), and triple gang (6-3/8" x 4-1/2") wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles. Boxes shall have the ability to accommodate a bracket (EFB-50A) allowing for one (1) 50-amp receptacle. Boxes shall also accommodate workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers and other open system devices.
6. Model EFB8S-FC Floor Boxes: Manufactured from stamped steel approved for use in 2-hour fire- rated concrete floors. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall have a polyester based backed enamel finished interior (white). Boxes shall be 15-3/16" L x 13-7/8" W x 4-3/16" H [385mm x 351mm x 107mm]. Provide boxes with a 21-3/4" L x 17-1/4" W x 6-1/2" H [552mm x 438mm x 165mm] sheet metal concrete pan to ensure that 3-1/4 inches [83mm] of concrete surrounds the box. Provide boxes with eight (8) independent wiring compartments that allow for up to eight (8) receptacles, communication and/or audio/video services. Boxes shall have removable and repositionable dividers to permit feed to adjacent compartments and reconfiguration of devices. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the compartments shall have a minimum wiring capacity of 53-in3 [860ml]. Each of the eight (8) compartments shall have a minimum depth of 3-1/2" [89mm] behind the plate. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. Provide boxes with removable compartments to facilitate installation. Provide boxes with four (4) intumescent services

feed stems with a 1-1/4-inch [32mm] pass-through channel that allows the pathway to close off during a fire. Boxes shall be fully adjustable, accommodating a maximum 2-1/2-inch [64mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. The box shall be able to accept standard size single gang (2-3/4" x 4-1/2"), double gang (4-9/16" x 4-1/2"), and triple gang (6-3/8" x 4-1/2") wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles. Boxes shall have the ability to accommodate a bracket (EFB-50A) allowing for one (1) 50-amp receptacle. Boxes shall also accommodate workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

7. Model EFB10S Floor Boxes: Manufactured from stamped steel approved for use on above grade concrete floors, raised floors and wood floors with the same product. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall have a polyester based backed enamel finished interior (white). Boxes shall be 15-3/16" L x 12-3/4" W x 6-1/16" H [385mm x 324mm x 154mm]. Provide boxes with provisions that enable installation into concrete floors, raised floors, or wood floors without having to purchase additional components or accessories. Provide boxes with 10 independent wiring compartments that allow for up to 10 receptacles, communication and/or audio/video services. Boxes shall permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Six (6) of the 10 compartments shall have a minimum wiring capacity of 23-1/2-in3 [597ml]. Four (4) of the 10 compartments shall have a minimum wiring capacity of 27-in3 [686ml]. Each of the 10 compartments shall have a minimum depth of 3-1/2" [89mm] behind the plate. Provide boxes with removable compartments to facilitate installation and moves, additions, and changes. The compartments shall be removable from the top and back of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. Provide boxes with removable knockout plates to allow for the maximum cable pass-through area. The cable pass-through area shall be a minimum of 11-5/8 in2 [7500mm2]. The box shall contain the following number of knockouts: four (4) 3/4-inch trade size, 10 1-inch trade size, eight (8) 1-1/4-inch trade size, and two (2) 2-inch trade size. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. Equip boxes with toggle clamps to allow box to be secured to raised and wood floors. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles. Boxes shall have the ability to accommodate a bracket (EFB-50A) allowing for one (1) 50-amp receptacle. Boxes shall also accommodate workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.
8. Model EFB10S-OG Floor Boxes: Manufactured from stamped steel approved for use in above grade and on-grade floor applications. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall be painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete, and be approved for use on-grade and above grade floors. Boxes shall be 15-3/16" L x 12-5/8" W x 6-1/16" H [385mm x 321mm x 154mm]. Provide boxes with 10 independent wiring compartments that allow for up to 10 duplex receptacles, communication and/or audio/video services. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a



tunnel. Six (6) of the 10 compartments shall have a minimum wiring capacity of 23-1/2-in<sup>3</sup> [597ml]. Four (4) of the 10 compartments shall have a minimum wiring capacity of 27-in<sup>3</sup> [686ml]. Each of the 10 compartments shall have a minimum depth of 3-1/2" [89mm] behind the plate. Provide boxes with removable compartments to facilitate installation. The compartments shall be removable from the top of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. The box shall contain the following number of knockouts: 14 1-inch trade size, six (6) 1-1/4-inch trade size, and four (4) 2-inch trade size. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles. Boxes shall have the ability to accommodate a bracket (EFB-50A) allowing for one (1) 50-amp receptacle. Boxes shall also accommodate workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

9. Model EFB10FC Floor Boxes: Manufactured from stamped steel approved for use in 2-hour fire-rated concrete floors. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall have a polyester based backed enamel finished interior (white). Boxes shall be 15-3/16" L x 13-7/8" W x 4-3/16" H [385mm x 351mm x 107mm]. Provide boxes with a 21-3/4" L x 17-1/4" W x 6-1/2" H [552mm x 438mm x 165mm] sheet metal concrete pan to ensure that 3-1/4 inches [83mm] of concrete surrounds the box. Provide boxes with 10 independent wiring compartments that allow for up to 10 receptacles, communication and/or audio/video services. Boxes shall have removable and repositionable dividers to permit feed to adjacent compartments and reconfiguration of devices. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the compartments shall have a minimum wiring capacity of 53-in<sup>3</sup> [860ml]. Each of the 10 compartments shall have a minimum depth of 3-1/2" [89mm] behind the plate. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. Provide boxes with removable compartments to facilitate installation. The compartments shall be removable from the top of the floor box. Provide boxes with four (4) intumescent services feed stems with a 1-1/4-inch [32mm] pass-through channel that allows the pathway to close off during a fire. Boxes shall be fully adjustable, accommodating a maximum 2-1/2-inch [64mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles. Boxes shall have the ability to accommodate a bracket (EFB-50A) allowing for one (1) 50-amp receptacle. Boxes shall also accommodate workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.
10. Model EFBFF Floor Boxes: Manufactured from stamped steel approved for use on above grade concrete floors, raised floors and wood floors with the same product. Boxes shall have the ability to accept a component (FP-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall be 7-1/16" L x 6-5/8" W x 4-1/8" H [179mm x 168mm x 105mm]. Provide boxes with provisions that enable installation into concrete floors, raised floors, or wood floors without having to purchase additional components or accessories. Provide boxes with two (2) independent wiring compartments that allow for power, communication and/or audio/video services. Each of the two (2) wiring compartments shall have a minimum wiring capacity of 64- 1/2-in<sup>3</sup> [1056ml]. The box shall be equipped with a metal divider to separate the services and maintain code requirements. The box shall contain the following number of knockouts:

four (4) 1/2-inch trade size, four (4) 3/4"-inch trade size, one (1) 1-inch trade size, six (6) 1-1/4-inch trade size, one (1) 1-1/2-inch trade size, and two (2) 2-inch. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. Equip boxes with toggle clamps to allow box to be secured to raised and wood floors.

11. Model EFBFF-OG Floor Boxes: Manufactured from stamped steel approved for use in above grade and on-grade floor applications. Boxes shall have the ability to accept a component (FP- CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall be painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete, and be approved for use on-grade and above grade floors. Boxes shall be 7-1/16" L x 6-5/8" W x 4-1/8" H [179mm x 168mm x 105mm]. Provide boxes with provisions that enable installation into concrete floors, raised floors, or wood floors without having to purchase additional components or accessories. Provide boxes with two (2) independent wiring compartments that allow for power, communication and/or audio/video services. Each of the two (2) wiring compartments shall have a minimum wiring capacity of 64- 1/2-in<sup>3</sup> [1056ml]. The box shall be equipped with a metal divider to separate the services and maintain code requirements.

The box shall contain the following number of knockouts: four (4) 1/2-inch trade size, four (4) 3/4"-inch trade size, one (1) 1-inch trade size, six (6) 1-1/4-inch trade size, one (1) 1-1/2-inch trade size, and two (2) 2-inch. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment.

- D. Activation Covers: The following model covers shall be used according to the appropriate application.

1. Evolution EFB610BT and EFB610CT Series Covers: Manufactured of die-cast aluminum. Activation covers shall be available in surface mount and flush versions. Provide covers with two (2) gaskets (one (1) for carpet and one (1) for tile) to go under the trim flange to maintain scrub watertightness. Covers shall be 16-15/16" x 12-1/2" x 3/16" [430mm x 318mm x 4mm]. Covers shall be available with a carpet recess area or a solid lid. Secure the cover to the flange and enable cover to rotate greater than 180 degrees to reduce trip hazards and provide maximum amount of working space. Provide covers with spring-loaded self-closing slide egress doors to reduce egress opening when cables are exiting and reduce trip hazards. Each of the two (2) egress openings shall have a minimum of 4-in<sup>2</sup> [102mm<sup>2</sup>], or a minimum of 8-in<sup>2</sup> [203mm<sup>2</sup>] per cover assembly. Cover finish shall be as follows:
2. FloorPort FPFFTC Series Covers: Manufactured of die-cast aluminum or die-cast zinc, and available in brushed aluminum finish and powder-coated paint finishes (black, gray, bronze, nickel and brass). Activation covers shall be available in flanged version. Covers shall come equipped with one (1) 1-inch trade size screw plug opening and one (1) combination 1-1/4-inch and 2-inch trade size screw plug.

- a. Flanged covers shall be 7-3/4" L x 6-9/16" W [197mm x 167mm].

## 2.5 FIRE STOPPING

- A. Fire Stopping materials used for this project shall comply with the following:

1. Products shall allow for normal expansion and contraction movement of the penetrating item without failure of the penetration seal.
2. Products shall emit no hazardous, combustible, or irritating by-products during installation or curing period.
3. Products shall not require special tools for installation.
4. Products shall provide penetration seal assemblies whose fire-resistance ratings have been determined by testing in the configurations required and which have fire-resistance ratings at least as high as that of the fire-rated assembly in which they are to be installed.
5. All fire stopping shall be manufactured by the following:
  - a. Bio Fireshield, Inc.
  - b. Dow Corning Corp.
  - c. GE Silicones, Hilti, Inc.
  - d. 3M Ceramic Materials.
  - e. Or Approved Equal

### PART 3 - EXECUTION

#### 3.1 PATHWAYS

- A. Pathways shall be designed and installed to meet applicable local and national building and electrical codes or regulations and shall have no exposed sharp edges that may come into contact with data or telecommunications cables.
- B. All wall penetrations shall be installed with sleeves that shall have no exposed sharp edges that may come into contact with data or telecommunications cables.
- C. Pathways shall not be located in elevator shafts unless specifically approved by the Design Consultant in writing.

#### 3.2 CABLE PATHWAYS

- A. Horizontal pathways shall be installed or selected such that the minimum bend radius of horizontal cables is kept within manufacturer specifications both during and after installation.
- B. Cable pathways, which run parallel with electric power or lighting that is less than or approved equal to 480 Vrms, shall be installed with a minimum clearance of 6 in.
- C. In the MDF/IDF(s) where cable trays or cable racking are used, the appropriate means of cable management such as reusable color-coded hook and loop cable managers (ties) shall be used to create a neat appearance and practical installation.
- D. Continuous conduit runs installed by the contractor should not exceed 100 feet or contain more than two (2) 90 degree bends without utilizing appropriately sized pull boxes.
- E. All horizontal pathways shall be designed, installed and grounded to meet applicable local and national building and electrical codes.

#### 3.3 FIRE PROTECTION

- A. All wall penetrations shall require properly installed firestop systems code compliant that shall be installed to prevent or retard the spread of fire, smoke, water, and gases through the building.

- B. Sheathing installed for wall penetrations must also be firestopped.
- C. Fire stops shall be done to applicable code using approved materials.

END OF SECTION 270528

## SECTION 271000 – STRUCTURED CABLING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Wire, cable, and connecting devices for wiring systems to be used as signal pathway or voice, and high-speed data transmission.
- B. System Diagram: Refer to T-Drawings

### PART 2 - PRODUCT

#### 2.1 MATERIALS

- A. Acceptable Manufacturers
  - 1. Belden CDT Inc.; Electronics Division.
  - 2. Berk-Tek; a Nexans company.
  - 3. CommScope, Inc.
  - 4. Or approved equal.

#### 2.2 TWISTED – PAIR CABLES, CONNECTORS AND TERMINAL EQUIPMENT

- A. Voice Backbone, 100 Pair Category 6 UTP cable.
- B. Conductors: Solid copper conductors
- C. Cross-connect panel rack mounted
- D. Patch panel, rack mounted
- E. Horizontal UTP, 4-pair Category 6
- F. Workstation Outlets: Category 6 jack-connector assemblies.

#### 2.3 FIBER-OPTIC CABLES, CONNECTORS, AND TERMINAL EQUIPMENT:

- A. Cables: Factory fabricated, jacketed, glass type, multimode, graded index.
- B. Backbone, Strands per cable: 12 (6 pair)
- C. Patch panel Rack mounted

#### 2.4 COAXIAL CABLES, CONNECTORS AND TERMINAL EQUIPMENT

- A. Video Backbone: RG11 with double braid and tape shield.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLICATION OF MEDIA

- A. Backbone Cable for Data Service: Use multi-mode fiber-optic cable for runs between equipment rooms and wiring closets and for runs between wiring closets.
- B. Backbone Cable for Voice Service: Use UTP Category 3, 100 pair, for runs between equipment rooms and wiring closets and for runs between wiring closets.
- C. Horizontal Cable for Data Service: Use UTP Category 6 cable for runs between wiring closets (MDF/IDFs) and workstation outlets.
- D. Horizontal Cable for Voice Service: Use UTP Category 6 cable for runs between wiring closets (MDF/IDFs) and workstation outlets.

### 3.3 INSTALLATION

- A. Wiring Method: Install wiring and optical fiber in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.
- B. Install cables using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.
- C. Install cables without damaging conductors, shield, or jacket.
- D. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.
- E. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
  - 1. Pull cables simultaneously if more than one is being installed in same raceway.
  - 2. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
  - 3. Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips that will not damage media or raceway.
- F. Install exposed cables parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.
- G. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

- H. Wiring within Wiring Closets and Enclosures: Provide conductors of adequate length. Train conductors to terminal points with no excess. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radius than minimums recommended by manufacturer.
- I. Separation of Wires: Comply with TIA/EIA-569-A rules for separating unshielded copper voice and data communication cabling from potential EMI sources, including electrical power lines and equipment.
- J. Make splices, taps, and terminations only at indicated outlets, terminals, and cross-connect and patch panels.
- K. Use splice and tap connectors compatible with media types.

#### 3.4 GROUNDING

- A. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
- C. Signal Ground Bus: Mount on wall of main equipment room with standoff insulators.
- D. Signal Ground Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

#### 3.5 INSTALLATION IN EQUIPMENT ROOMS AND WIRING CLOSETS

- A. Install plywood backboards (furnished by others) on walls of equipment rooms and wiring closets.
- B. Mount patch panels, terminal strips, and other connecting hardware on backboards, unless otherwise indicated.
- C. Group connecting hardware for cables into separate logical fields.
- D. Use patch panels to terminate cables entering the space, unless otherwise indicated.

#### 3.6 INSTALLATION STANDARDS

- A. Comply with requirements in TIA/EIA-568-A and TIA/EIA-569-A.

#### 3.7 IDENTIFICATION

- A. In addition to requirements in this Article, comply with applicable requirements in TIA/EIA-606.
- B. Workstation: Label cables within outlet boxes.
- C. Distribution Racks and Frames: Label each unit and field within that unit.

- D. Within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- E. Cables, General: Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
- F. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m)
- G. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project, in software and format selected by the Authority.
- H. Cable Administration Drawings: Show building floor plans with cable administration point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606. Furnish electronic record of all drawings, in software and format selected by the Authority.

### 3.8 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.
  - 2. Copper Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bi-directional, Category 6 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA-TSB 67, "Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems." Link performance for UTP cables must meet minimum criteria of TIA/EIA-568-A.
  - 3. Fiber-Optic Cable Procedures: Perform each visual and mechanical inspection and electrical test, including optional procedures, stated in NETA ATS, Section 7.25. Certify compliance with test parameters and manufacturer's written recommendations. Test optical performance with optical power meter capable of generating light at all appropriate wavelengths.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

### 3.9 TESTING, IDENTIFICATION AND ADMINISTRATION

- A. Copper Cable
  - 1. All Category 6 UTP cable shall be tested to a frequency of 350MHz to demonstrate compliance with the individual manufacturers advertised electrical characteristics.



2. All Category 6 UTP cable shall be field-tested with connectivity products installed to a frequency of 250MHz to demonstrate performance equal to or better than the minimum requirements as specified in ANSI/TIA/EIA-568b.2.1 and as listed in Table 1.
3. The Test Model shall be Permanent Link

TABLE 1 - Category 6 Permanent Link Limits in dB per ANSI/TIA/EIA-568B.2-1

Parameter	Performance @ 100MHz	Performance @ 200MHz	Performance @ 250MHz	Performance @ 300MHz
Insertion Loss	19.0 dB	27.4 dB	30.9 dB	34.1 dB
NEXT Loss	43.9 dB	39.3 dB	37.8 dB	36.6 dB
PS NEXT Loss	41.9 dB	37.3 dB	35.8 dB	34.6 dB
ACR	24.9 dB	11.9 dB	6.9 dB	2.5 dB
PS ACR	22.9 dB	9.9 dB	4.9 dB	0.5 dB
ELFEXT	26.3 dB	20.3 dB	18.3 dB	16.8 dB
PS ELFEXT	23.4 dB	17.3 dB	15.4 dB	13.8 dB
Return Loss	14.7 dB	11.7 dB	10.7 dB	9.9 dB
Propagation Delay	528 ns	527 ns	526 ns	526 ns
Delay Skew	40 ns	40 ns	40 ns	40 ns

4. All testing shall be performed with a UTP/ScTP field test device that has been factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided for review prior to the start of testing.
5. Autotest settings provided in the field tester for testing the installed cabling shall be set to the default parameters.
6. Test settings selected from options provided in the field testers shall be compatible with the installed cable under test.
7. UTP horizontal and backbone cables shall be 100 percent tested according to ANSI/TIA/EIA-TSB-67 and ANSI/TIA/EIA-568-B.2.1. Test parameters include wire map plus shield continuity (when present), length, NEXT loss (pair-to-pair), NEXT loss (power sum), ELFEXT loss (pair-to-pair), ELFEXT loss (power sum), return Loss, attenuation, propagation delay, and delay skew.

#### B. Fiber Optic Cable

1. Backbone
  - a. Fiber backbone cables shall be 100% tested for attenuation and length.
  - b. Attenuation shall be tested at 850 nm and 1300 nm for 50/125 nm multimode in at least one direction using the 2-jumper method.
  - c. Acceptable attenuation test results shall be determined using the following calculation:
    - 1) Link attenuation = cable attenuation + connector attenuation + splice attenuation.
    - 2) Cable attenuation, connector attenuation and splice attenuation are determined by each of the following formulas:
      - a) Cable Attenuation:  
 Cable attn. (dB) = Attn. coefficient (dB/km) x length (km)  
 Attenuation Coefficient = 3.0 dB/km @ 850 nm

- b) Connector Attenuation:  
Connector attn. (dB) = number of connector pairs x connector loss = 2 x 0.65 dB = 1.3 dB
    - c) Splice Attenuation:  
Splice attn. (dB) = number of splices (s) x splice loss (dB) = s x 0.3 dB
  - d. The Backbone Channel performance guarantees are as follows:
    - 1) Max Attenuation 850/1300 nm: 3.0/1.0 dB 2) Bandwidth 850/1300 nm: 1500/500 MHz/km
    - 3) ☐ Min. Return Loss: 20dB
    - 4) For each additional mated pair of connectors, add the following to the attenuation values as noted in above chart:
      - a) add 0.75 dB @ 850nm
      - b) add 0.65 dB @ 1300nm
    - 5) For each splice, add 0.30 dB to the attenuation values as noted in above chart (applicable to both M/M and S/M).

### 3.10 CUTOVER

- A. The contractor shall place cross connects at Telecommunication Equipment Rooms.

### 3.11 Training

- A. Authority training shall include:
  - 1. Physical review of installed cable plant.
  - 2. Review of cable plant documentation and test results.
  - 3. Instructions on industry standard termination and testing methods to enable customer personnel to successfully terminate and test cabling.

### 3.12 DEMONSTRATION

- A. Train the Authority's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and extending wiring to establish new workstation outlets.

END OF SECTION 271000

## SECTION 271100 – COMMUNICATIONS EQUIPMENT ROOM FITTINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications pathways.
4. Grounding.

B. Related Sections:

1. Division 27 Section "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
2. Division 27 Section "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.

#### 1.2 SUBMITTALS

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

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies, and location and size of each field connection.
2. Equipment racks and cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail.

C. Qualification Data: For BICSI RCDD or experienced equivalent qualified layout technician, installation supervisor, and field inspector.

#### 1.3 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of an RCDD to be specified on the drawings.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician or Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- D. Grounding: Comply with ANSI-J-STD-607-A and NFPA 70.

#### 1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install equipment frames, cable trays and cabling until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

#### 1.5 COORDINATION

- A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
  - 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
  - 2. Record agreements reached in meetings and distribute them to other participants.
  - 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

### PART 2 - PRODUCTS

#### 2.1 PATHWAYS

- A. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable.
  - 1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
  - 2. Neatly support cabling and brackets; utilize cable tie slots for fastening cable ties to brackets, lacing bars, spools, J-hooks, and D-rings, Straps and other devices.
    - a. .
- B. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.
  - 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
  - 2. Increase effective depth of 4" square boxes by adding extensions to meet depth requirements. Plaster ring depth can be used to meet depth requirement.

## 2.2 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. All grounding conductors for communications shall be copper.
- C. Telecommunications Main Bus Bar:
  - 1. Connectors: Mechanical type, cast silicon bronze, solderless-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
  - 2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
  - 3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
- D. Comply with ANSI-J-STD-607-A.

## 2.3 LABELING

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## PART 3 - EXECUTION

### 3.1 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- B. Install underground/buried/aerial pathways complying with design documents and recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.
- C. Install underground/buried/aerial entrance pathway complying with Division 26 Section "Raceway and Boxes for Electrical Systems."
- D. Comply with NECA 1.
- E. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- F. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- G. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- H. Cables shall not be installed using building steel as a cable support.

### 3.2 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar in each IDF with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to the grounding bus bar in the MDF.
- D. Connect grounding bus bar in the MDF to the grounding electrode of the panel serving the MDF equipment with 2 minimum No. 4 AWG conductor.
- E. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems." Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration.
- C. Labels shall be preprinted or computer-printed type.

END OF SECTION 271100

## SECTION 271110 - NETWORK EQUIPMENT

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract including the General and Supplementary conditions and Division 1 Specification Sections apply to the work of this Section.

#### 1.02 SUBMITTALS

- A. Installers training certifications for all installers.
- B. Schedule of all materials. Schedule shall indicate device model numbers, quantity required, locations used in project, etc. in spreadsheet form.
- C. Descriptive product data on all equipment.
- D. Wiring and equipment rack construction and accessories.
- E. Wiring and equipment rack arrangement drawings indicating all internal equipment points including node identification numbers, and major internal cable routing.

### PART 2 - PRODUCTS

#### 2.01 WIRE HANGERS

- A. J-Hooks: Extra wide J-hook type hanger with velcro, 2" for up to (84) cables, CPI Chatsworth Part #31422-801 for 2" J-hook. Located every 4'-0" as needed for cables run without channel tray. Supply appropriate upper hanger attachment accessories as required; beam clamps or concrete anchors, CPI Chatsworth Products; or equal.
  - 1. Provide Panduit strap around bottom of J-hook and thru closure holes to contain cables.

#### 2.02 WIRE MANAGEMENT

- A. Enclosure Cable Management (Front and Side):
  - 1. Refer to Rack Layout Diagrams.
  - 2. Wire Management Panels: 19" rack mount panduit duct on front and back both with covers, strain relief clips at all ends, Part #WMP1, Panduit Co. Network Systems Division; or equal.
  - 3. Open Rack Cable Management (Front and Side): Add Panduit Management to all WC double data racks.
    - a. Front and Rear (horizontal) Model #WMPH2
    - b. Vertical (side) Full Length Model #WMPVHC45E
    - c. Center (side) Full Length Model #WMPVHC45E with WMPVCBE

## 2.03 WIRE AND EQUIPMENT RACKS

### A. Schedule of Equipment Enclosures:

1. See drawing floor plans for locations, riser and detail sheets for individual rack configurations.
2. NOTE: Provide all components listed. All components listed are NOT included with the Base Part numbers.

School		-----
Rack Number		WC-1
Location Room #		Boiler Room
Enclosure Type		Wall Enclosure
Size HxWxD		Chatsworth 12419-X24
Rack Units		12
Wire Management		
Front		-----
Vertical (side)		Yes
Vertical (center)		Yes
Shelves (Qty.)		-----
Monitor Shelf (Qty.)		-----
Computer Shelf (Qty.)		-----
Telescoping Tray (Qty.)		-----
Depth Bar Qty./Model # (2)		-----
Self Contained A/C		
Power Strip		See Dwgs for Qty
Mounting Screws		50
Fan Kit		40975-001

#### Notes:

- (1) Anixter; or approved equal.
- (2) APC or approved equal.
- (3) Shelves for WC's shall be located at bottom of unit.

## PART 3 - EXECUTION

### 3.1 WIRING CLOSETS

- A. Where wiring and/or equipment enclosures are shown adjacent on drawings, provide interconnecting kits; do not provide intermediate side walls.
- B. Gaps or open joints at enclosure interconnection are not permitted.
- C. After installation of all enclosures remove transportation eye bolts from top of enclosures and replace with (4) roof panel bolts.



- D. Coordinate with EC for exact location of wiring closets. Racks shall be located directly above cable tray.
- E. After installation of rough wiring in enclosures, contractor shall completely clean and vacuum all interior surfaces of enclosures.
- F. For final completion, contact Owner's Representative for final review of all data closets.

END OF SECTION 271110



## SECTION 271300 – COMMUNICATIONS BACKBONE CABLING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Pathways.
2. UTP cable.
3. Fiber Optic cable.
4. Cable connecting hardware, patch panels, and cross-connects.
5. Cabling identification products.

#### 1.2 BACKBONE CABLING DESCRIPTION

- A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

#### 1.4 SUBMITTALS

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

##### B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. Cabling administration drawings and printouts.
3. Wiring diagrams to show typical wiring schematics including the following:
  - a. Cross-connects.
  - b. Patch panels.
  - c. Patch cords.
4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
5. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements.

- C. Qualification Data: For RCDD qualified layout technician, installation supervisor, and field inspector.
- D. Warranty: Provide manufacturer's system warranty against electrical or mechanical defects for 2 years from date of final acceptance.
- E. Source quality-control reports.
- F. Field quality-control reports.
- G. Maintenance data.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  - 1. Layout Responsibility: Preparation of Shop Drawings and Cabling detail /administration Drawings by an RCDD.
  - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician or Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- E. Grounding: Comply with ANSI-J-STD-607-A and NFPA 70.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site. Test each pair of UTP cable for open and short circuits.

## PART 2 - PRODUCTS

### 2.1 PATHWAYS

- A. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable.
  - 1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.

2. Neatly support cabling and brackets; utilize cable tie slots for fastening cable ties to brackets, lacing bars, spools, J-hooks, and D-rings, Straps and other devices.

## 2.2 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Belden CDT Inc.; Electronics Division.
  2. CommScope, Inc.
  3. Leviton
  4. Superior Essex Inc.
  5. SYSTIMAX Solutions; a CommScope Inc. brand.
- B. Description: 100-ohm, 100 -pair UTP, formed into 25-pair binder groups covered with a gray thermoplastic jacket and overall metallic shield.
  1. Comply with ICEA S-90-661 for mechanical properties.
  2. Comply with TIA/EIA-568-B.1 for performance specifications.
  3. Comply with TIA/EIA-568-B.2, Category 6.
  4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
    - a. Communications, General Purpose: Type CM or CMG
    - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
    - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
    - d. Communications, Limited Purpose: Type CMX.
    - e. Multipurpose: Type MP or MPG.
    - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
    - g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

## 2.3 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Hubbell Premise Wiring.
  2. Leviton Voice & Data Division.
  3. Panduit Corp.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
  1. Number of Terminals per Field: One for each conductor in assigned cables.

- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
  - 1. Number of Jacks per Field: One for each four-pair Category 6 conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- G. Patch Cords: Factory-made (pre-fab), 4-pair cables in 36 and 48-inch lengths; terminated with 8-position modular plug at each end.
  - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
  - 2. Patch cords shall have color-coded boots for circuit identification.

## 2.4 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

## 2.5 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## 2.6 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

# PART 3 - EXECUTION

## 3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

### 3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
  - 2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

### 3.3 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.
- B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
- C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- D. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
  - 2. Install cable trays to route cables if conduits cannot be located in these positions.
  - 3. Secure conduits to backboard when entering room from overhead.
  - 4. Extend conduits 3 inches above finished floor.
  - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- G. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

### 3.4 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
10. In the communications equipment room, install a 10-footlong service loop on each end of cable.
11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.

F. Group connecting hardware for cables into separate logical fields.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.



- b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
- 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
- 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
- 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
- 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

### 3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

### 3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
  - 1. Administration Class: 2
  - 2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. See Evaluations for discussion about TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of

administration including optional identification requirements specified on drawings and/or in of this standard.

- D. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- F. Cable and Wire Identification:
  - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
  - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
  - 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
    - a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
    - b. Label each unit and field within distribution racks and frames.
  - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:
  - 1. Cables use flexible vinyl or polyester that flexes as cables are bent.

### 3.7 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Visually inspect UTP jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
  - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  - 3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

- a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- B. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- C. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- D. Prepare test and inspection reports.

END OF SECTION 271300



## SECTION 271400 - FIBER OPTIC CABLE AND EQUIPMENT

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 WORK INCLUDED

- A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents

#### 1.03 SCOPE

- A. Backbone cabling includes copper and optical fiber cabling from the service entrance to the main communication rooms and cable between the main communication room and secondary communication rooms.
- B. Re-Termination of all existing Single mode fiber in all buildings, provide new LC connectors and path panels as required.
- C. Installation of Site fiber in existing conduits and provide new terminations and patch panels as required with LC connectors.
- D. This section includes minimum requirements for the following:
  - 1. Fiber Optic Backbone cable.

#### 1.04 QUALITY ASSURANCE

- A. All cable shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
- B. Materials and work specified herein shall comply with the applicable requirements of:
  - 1. ANSI/TIA/EIA – 568B.X (2000 or newer edition)
  - 2. ANSI/TIA/EIA – 569A (1998 or newer edition)
  - 3. NFPA 70 - 2002
  - 4. BICSI Telecommunications Distribution Methods Manual, current edition
  - 5. FCC 47 CFR 68
  - 6. NEMA - 250
  - 7. NEC - Articles 725, 760, 770 and 800
  - 8. IEEE C2 National Electrical Safety Code
  - 9. ISO/IEC 11801
  - 10. ANSI-J-STD-607-A
  - 11. ANSI/TIA/EIA 606-A (2002 or current edition)
  - 12. ANSK/NECA/BICSI 568 (2001 or current edition)

- C. The optical fiber cable plant shall be used to support Gigabit and 10-Gigabit Ethernet networks.
- D. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.

#### 1.05 SUBMITTALS

- A. Manufacturers catalog sheets, specifications and installation instructions for all cable, connecting hardware and patch cables.
- B. Termination details for all cable types.
- C. Cable Test Reports (at substantial completion).
- D. Cable tension reports for optical fiber pulls backbone pulls over 200'.

### PART 2 – PRODUCTS

#### 2.01 FIBER OPTIC CABLE

- A. Cable shall be plenum rated and meet the requirements Flame Test: UL 910 (NFPA 262 1994).
- B. All fibers in the cable must be usable fibers and meet required specifications.
- C. All optical fibers shall be sufficiently free of surface imperfections and inclusions to meet the optical, mechanical, and environmental requirements of this specification.
- D. Each optical fiber shall consist of a doped silica core surrounded by a concentric glass cladding. The fiber shall be a matched clad design.
- E. All optical fibers shall be proof tested by the fiber manufacturer at a minimum of 100 kpsi.
- F. The fiber shall be coated with a dual layer acrylate protective coating. The coating shall be in physical contact with the cladding surface.
- G. The coated fiber shall have a layer of Teflon\* placed between the dual layer acrylate coating of the optical fiber and the thermoplastic buffer. The diameter of the thermoplastic buffer coating shall be  $900 \pm 50$  \*m.
- H. The fiber coating and buffer shall be removable with commercially available stripping tools in a single pass.
- I. The multimode fiber utilized in the cable specified herein shall be OM4 50  $\mu$ m laser-optimized fiber with extended bandwidth.
- J. The non-dispersion shifted single-mode fiber utilized in the cable specified herein shall conform to the following specifications:
  - 1. Typical Core Diameter: 8.3 \*m.

2. Cladding Diameter:  $125.0 \pm 1.0$  \*m.
3. Core-to-Cladding Offset: \* 0.6 \*m.
4. Cladding Non-Circularity: \* 1.0%.
5. Coating Diameter:  $245 \pm 10$  \*m.
6. Attenuation Uniformity- No point discontinuity greater than 0.1 dB at either 1310 nm or 1550 nm.
7. Attenuation at the Water Peak- The attenuation at  $1383 \pm 3$  nm shall not exceed 2.1 dB/km.
8. Cutoff Wavelength- The cabled fiber cutoff wavelength shall be  $< 1260$  nm.
9. Mode Field Diameter:  $9.30 \pm 0.50$  \*m at 1310 nm,  $10.50 \pm 1.00$  \*m at 1550 nm
10. Zero Dispersion Wavelength (\*o)- 1301.5 nm \* \*o \* 1321.5 nm.
10. Zero Dispersion Slope (So)- \* 0.092 ps/(nm<sup>2</sup>\*km).
11. Fiber Curl:  $> 4.0$  m radius of curvature.

K. Physical Characteristics:

1. Plenum Cables up to 24 Fiber.
2. The fibers may be stranded around a dielectric central member and surrounded by layered aramid yarns. The aramid yarns shall serve as the tensile strength member of the cable.

L. Plenum Cables with 24 to 72 Fibers:

1. The buffered fibers shall be grouped in six fiber subunits. In each subunit, the individual fibers shall be stranded around a dielectric central member and surrounded by layered aramid yarns.
2. A ripcord shall be incorporated in the subunit design to facilitate access to the individual fibers.
3. The subunit jacket shall be extruded over the aramid yarns for additional physical and environmental protection.
4. The subunits shall be stranded around a dielectric central member.
5. A ripcord shall be inserted beneath the outer jacket to facilitate jacket removal.
6. The outer jacket shall be extruded around the units for physical and environmental protection.

M. Strength Members:

1. The strength member shall be a high modulus aramid yarn.
2. The aramid yarns shall be helically stranded around the buffered fibers.
3. A non-toxic, non-irritant talc shall be applied to the yarn to allow the yarns to be easily separated from the fibers and the jacket.

N. Cable Jacket:

1. The jacket shall be interlocking armored for all fiber cable.

O. The cable shall be all-dielectric.

- P. The individual fibers shall be color coded for identification. The optical fiber color coding shall be in accordance with EIA/TIA-598, "Color Coding of Fiber Optic Cables." The coloring material shall be stable over the temperature range of the cable, shall not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers. Color coded buffered fibers shall not adhere to one another. When fibers are grouped into individual units, each unit shall be numbered on the unit jacket for identification. The number shall be repeated at regular intervals.
- Q. The outer cable jacket shall be marked with the manufacturer's name or file number, date of manufacture, fiber type, flame rating, listing mark, and sequential length markings every two feet. The marking shall be in contrasting color to the cable jacket.
- R. The cable shall withstand a minimum compressive load of 890 N/cm (500 lbf/in) applied uniformly over the length of the compression plate. The cable shall have an aluminum or steel interlock armor that increases the crush resistance at least ten times that of standard fiber cable, typically 89 N/cm (50 lbf/in). The cable shall be tested in accordance with FOTP- 41, "Compressive Loading Resistance of Fiber Optic Cables." While under compressive load, the fibers shall not experience an attenuation change greater than 0.4 dB at 1550 nm (single-mode) or greater than 0.6 dB at 1300 nm (multimode). After the compressive load is removed, the fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (single-mode) or greater than 0.4 dB at 1300 nm (multimode).
- S. The cable shall withstand a minimum of 20 impact cycles. The cable shall be tested in accordance with FOTP-25, "Repeated Impact Testing of Fiber Optic Cables and Cable Assemblies." The fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (single mode) or greater than 0.4 dB at 1300 nm (multimode).
- T. The cable shall withstand 25 mechanical flexing cycles at a rate of  $30 \pm 1$  cycles per minute. The cable shall be tested in accordance with FOTP-104, "Fiber Optic Cable Cyclic Flexing Test." The fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (single mode) or greater than 0.4 dB at 1300 nm (multimode).
- U. All cables shall comply with the requirements of the National Electrical Code (NEC), Article 770. Plenum cables (OFNP and OFCP) shall pass UL-910.
- V. Design Make: Exterior Armored Fiber Optic Cable Corning
  - 1. Exterior 12 strand SM: ALTOS Lite Loose Tube Single Jacket Single Armored Cable with fast access technology 12 F single mode (OS2).
    - a) Part Number 012ZUC-T4F22D20

## 2.02 OPTICAL FIBER CABLE CONNECTORS

- A. High-precision connectors with insert loss – 0.1 dB typical/0.5 dB maximum per connector pair for multimode, 0.2 dB typical/0.5 dB maximum per connector pair for single-mode.
- B. Singlemode Fiber Connectivity (OS2)
  - 1. The optical fiber fusion splice connector shall be ST, for fusion splice onto singlemode 8.3/125-micron fiber.



2. The optical fiber field-installable connector shall be compatible with 900-micron buffered fibers or 250-micron loose-tube fibers.
  3. The preferred method of terminating loose-tube singlemode fiber is pigtail splicing into a rack mounted optical fiber panel or wall-mounted enclosure. Pigtails shall be factory terminated and 3 meters in length. A fiber enclosure with slack storage trays must be used when pigtail-splicing method is used.
  4. The splice loss through each connector pair shall not exceed 0.50 dB.
  5. The optical fiber adapter module that occupies the faceplate shall be equipped with zirconia ceramic sleeve.
  6. Singlemode fiber connector color shall be blue.
- C. Design Make: Corning Cable Systems Closet Connector Housing Pigtail Cassette.
1. Closet connector housing (CCH) pigtail cassette, loaded with CCH panel and factory terminated pigtails 12F, LC compatible SM/UPC single fiber splicing.
    - a) Part Number CCH-CS12-A9-P00RE

## 2.03 FIBER ENCLOSURE

- A. Shall be rack mounted.
- B. Front and rear transparent polycarbonate doors and chassis covers
- C. Magnified label holders to clearly identify fiber connections
- D. Shall be constructed with 16-gauge steel.
- E. Housings have sliding tray (01U and 02U) or open top at front (03U and 04U)
- F. Meets ANSI/TIA/EIA-568A and 606
- G. 17" enclosure depth
- H. Fiber management rings that are adjustable and stackable for optimized fiber slack organization
- I. Mounting provisions for buffer tube fan-out kits
- J. Provide LC connector housing panels as required to accommodate all fiber called for.
- K. Shall accommodate 24, 48, 72, 96, or 144 fibers as called for on the drawing rack elevations and drawings.
- L. Design Make: Corning CCH series

## PART 3 - EXECUTION

### 3.01 OPTICAL FIBER

- A. Bending Radius:
  1. Do not exceed the cable's minimum bend radius. Bending cable tighter than the minimum bend radius may result in increased optical fiber attenuation, optical fiber breakage, or the development of microfractures.
  2. Nonconductive backbone optical fiber cables shall have a minimum bend radius of 10 times the cable's outside diameter when under no load and 15 times the cable's outside diameter when being pulled.
  3. Conductive backbone optical fiber cables shall have a minimum bend radius of 10 times the cable's outside diameter when under no load and 20 times the cable's outside diameter when being pulled. Check manufacturer's specifications on the cable bend radius requirements.

- B. Furnish Strain relief at top of vertical rise.
- C. Innerduct shall be provided for all interior building optical fiber cables, in a minimum of 1" diameter. Place innerduct inside EMT conduits or provide plenum rated. Place a spare pull- line in during installation of the innerduct.
- D. Optical Fiber splices are not allowed. Should fiber be broken during installation the entire run shall be replaced.
- E. Interior cable installed in accessible ceilings shall be installed in open top cable hangers 4 foot on center or in cable tray. Install the cables as close to the ceiling deck as possible in a segregated pathway. Do not install with UTP or coax cables.
- F. Provide tie wraps to close top of cable hangers after installation is complete.
- G. Exterior cable shall be installed in one of the following methods:
  - 1. Underground ductbank
  - 2. Inner duct across roof
  - 3. EMT conduit for installations more than 50 feet inside building.
  - 4. Messenger wire supported across road. Provide galvanized steel messenger and wrap spiraled around fiber and support system to even distribute fiber cable weight between distribution points.
- H. Maintain polarization for entire system as described in ANSI/EIA/TIA-568-A section 12.7.1.

END OF SECTION 271400

## SECTION 271500 HORIZONTAL CABLING

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including all General Conditions, Supplementary Conditions, Division 1 specification sections as well as Information to Bidders requirements that are included in the project documents, apply to the work of this Contract.

#### 1.02 SCOPE OF WORK

- A. Provide labor, materials, equipment, and services to perform the work required for a complete installation as required in the Contract Documents.
- B. This section shall include the following:
  - 1. Category 6 and 6A cable
  - 2. Patch Panels
  - 3. Communications Faceplates
  - 4. Termination Jacks
  - 5. 568B Termination of Cabling

#### 1.03 REFERENCES

- A. The products and work herein specified shall comply with the current additions of the following publications and standards.
  - 1. UL - Underwriter Laboratory
  - 2. NEC – National Electric Code
    - a. Article 725
    - b. Article 770
    - c. Article 800
  - 3. NFPA – National Fire Protection Association
  - 4. NECA - Standard of Installation
  - 5. ANSI – American National Standards Institute
  - 6. NEMA – National Electrical Manufacturers Association
    - a. Article 250

7. EIA – Electronic Industries Alliance
    - a. ANSI/TIA/EIA-568-C.2.
    - b. ANSI/EIA/TIA 569B
    - c. ANSI/EIA/TIA 606A
    - d. ANSI-J-STD-607-A
    - e. ANSI/TIA/EIA-606-A
  8. TIA – Telecommunications Industry Association
  9. IEEE C2 National Electrical Safety Code
  10. FCC - Federal Communications Commission
    - a. CFR 68
  11. BICSI – Building Industry Consulting Services International
    - a. Distribution Methods Manual
    - b. ANSK/NECA/BICSI 568
  12. ISO/IEC 11801
- B. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.

#### 1.04 QUALITY ASSURANCE

- A. All work shall be provided in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents, shall be provided in accordance with industry standards and shall be subject to the control and approval of the Owners representative.
- B. Equipment and materials shall be of the quality and manufactures indicated. The equipment specified is based on the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified, and subject to the approval of the Engineer.
- C. Strictly adhere to all Category 6 (BICSI and TIA) and manufacturer recommended installation practices when installing high performance cabling.
- D. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

## 1.05 SUBMITTALS

- A. Provide manufactures cutsheets, specifications, and installation instructions for the products herein specified.
  - 1. Category 6 and 6A cable
  - 2. Category 6 and 6A Patch Panels
  - 3. Communications Faceplates
  - 4. Wall Phone Faceplates
  - 5. Modular Jacks
- B. Termination details for all cable types.

## PART 2 PRODUCTS

### 2.01 CATEGORY 6 100 OHM UNSHIELDED TWISTED PAIR CABLE

- A. The horizontal balanced twisted pair cable shall exceed the Category 6 transmission characteristics per issue of ANSI/TIA/EIA-568-C.2.
- B. Shall be independently verified to comply with ANSI/TIA/EIA-568-C.2.
- C. An ISO 9002 Certified Manufacturer shall make the cable.
- D. Cable shall be UL LISTED.
- E. Cable shall be plenum rated
- F. Physical Characteristics:
  - 1. Shall be CMP (plenum rated) rated and meet applicable requirements of ANSI/ICEA S-80-576 and NEC.
  - 2. Conductor shall be 24 AWG solid bare annealed copper.
  - 3. Outer jacket colors shall be green for wireless access points, Blue for Data or voice outlets.
  - 4. Category marking shall be printed every one foot. Footage indicators shall also be provided on jacket.
  - 5. The diameter of the insulated conductor shall be .023 in. maximum.
  - 6. Shall consist of (4) 24 AWG twisted pairs.
  - 7. Shall be suitable for the environment in which they are to be installed.
  - 8. The color coding of pairs shall be:

Pair 1	W-BL; BL
Pair 2	W-O; O
Pair 3	W-G; G
Pair 4	W-BR; BR
  - 9. The ultimate breaking strength measured in accordance with ASTM D 4565 shall

be 400 N minimum.

10. Cable shall withstand a bend radius of 1 inch at -20 degrees Celsius without jacket or insulation cracking.

G. Compliance :

1. ANSI/TIA-568-C.2
2. U.L. 444
3. U.L. 1666
4. NFPA 262

H. Impedence - 100 Ohm +/- 15

I. Cable Electrical Table 1:

Freq. (MHz)	Max. Attenuation (dB/100 m)	Min. NEXT	Min. PSNEXT	Min. ACR (dB)	Min. PSACR	Min RL
1	2.000	75.3	75.3	73.3	73.3	20.000
4	3.700	66.3	66.3	62.6	62.6	23.000
8	5.200	61.8	61.8	56.6	56.6	24.500
10	5.800	60.3	60.3	54.5	54.5	25.000
16	7.400	57.2	57.2	49.9	49.9	25.000
20	8.300	55.8	55.8	47.5	47.5	25.000
25	9.300	54.3	54.3	45.1	45.1	24.300
31.25	10.400	52.9	52.9	42.5	42.5	23.600
62.5	15.000	48.4	48.4	33.4	33.4	21.500
100	19.300	45.3	45.3	26.0	26.0	20.800
155	24.600	42.4	42.4	17.9	17.9	19.500
200	28.300	40.8	40.8	12.5	12.5	18.700
250	32.100	39.3	39.3	7.2	7.2	18.000
300	35.600	38.1	36.1	2.5	0.5	17.500
350	38.900	37.1	35.1	-1.8	-3.8	17.000
400	42.000	36.3	34.3	-5.7	-7.7	16.600
450	45.000	35.5	33.5	-9.5	-11.5	16.200
500	47.900	34.8	32.8	-13.1	-15.1	15.900
550	50.600	34.2	32.2	-16.4	-18.4	15.600

Cable Electrical Table 2:

Freq.	Input (Unfitted)	Fitted	Min.	Min.
1	100 ± 15	100 ± 15	70.8	67.8
4	100 ± 15	100 ± 15	58.8	55.8
8	100 ± 15	100 ± 15	52.7	49.7
10	100 ± 15	100 ± 15	50.8	47.8
16	100 ± 15	100 ± 15	46.7	43.7
20	100 ± 15	100 ± 15	44.8	41.8
25	100 ± 15	100 ± 15	42.8	39.8
31.25	100 ± 15	100 ± 15	40.9	37.9
62.5	100 ± 15	100 ± 15	34.9	31.9
100	100 ± 15	100 ± 15	30.8	27.8
155	100 ± 22	100 ± 15	27.0	24.0
200	100 ± 22	100 ± 15	24.8	21.8
250	100 ± 32	100 ± 15	22.8	19.8
300	100 ± 32	100 ± 15	21.3	18.3
350	100 ± 32	100 ± 15	19.9	16.9
400	100 ± 32	100 ± 15	18.8	15.8
450	100 ± 32	100 ± 15	17.7	14.7
500	100 ± 32	100 ± 15	16.8	13.8
550	100 ± 32	100 ± 15	16.0	13.0

J. Design Make: Belden 2413

K. Acceptable Manufacturers:

1. Commscope
2. Berktek
3. Amp

## 2.02 CATEGORY 6 CONNECTING HARDWARE

A. Category 6 compliant modular jacks

B. Performance terminated on a 100M length of cable shall match requirements listed for Category 6 cable

C. Physical Characteristics

1. Jacks shall be 8 position un-keyed
2. Each jack shall be an individually constructed unit and shall snap mount in an industry standard keystone opening (.760" x .580")
3. Jack housings shall be high impact 94 V-0 rated thermoplastic
4. Jacks shall have a temperature rating of -10 °C (14°F) to 60°C (140 °F) in conformance with ANSI/TIA/EIA-568-A
5. Jacks shall utilize a 2 layer printed circuit board to control NEXT
6. Jack housings shall fully encase and protect printed circuit boards and IDC fields.

7. Housing shall be ultrasonically welded for tamper resistance.
8. Modular jack contacts shall accept a minimum of 2500 mating cycles without degradation of electrical or mechanical performance.
9. Contacts will maintain a minimum vertical deflection force of 100 grams over deflection window.
10. Modular jack contact wires shall be formed flat for increased surface contact with mated plugs.
11. Contacts shall be arranged on the PC board in 2 staggered arrays, one array has 6 contacts and the other array has 2 contacts.
12. Modular jack contacts shall be constructed of Beryllium copper for maximum spring force and resilience.
13. Contact Plating shall be a minimum of 50 micro inches of hard gold in the contact area over 50 micro-inch of nickel.
14. Jack termination shall follow the industry standard 110 IDC.
15. IDC contact termination towers shall be paired and angled at 29.5 degrees.
16. IDC contacts shall be laid out in staggered arrays of 4 sets of 2 contacts.
17. Jacks shall have a designation indicating Category 6 on the nose which can be plainly seen from the front of the faceplate. Bottom of jack shall have date code and an abbreviated catalog number.
18. Jacks shall utilize a paired punch down sequence. Cable pair twists shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.
19. 110 IDC shall utilize 100 micro-inch tin lead plated (60% tin/40%lead) over phosphor bronze over nickel.
20. Jacks shall terminate 22-26 AWG stranded or solid conductors.
21. Jacks shall terminate insulated conductors with outside diameters up to .050"
22. Jacks shall be compatible with single conductor 110 impact termination tools.
23. Jacks shall include translucent wire retention stuffer cap, that hold terminated wires in place and allow the conductors to be visually inspected in the IDC housing.
24. Stuffer cap shall have a positive locking latch to provide conductor strain relief.
25. Stuffer cap used for wire termination with channel lock style pliers.
26. Jacks shall be compatible with TIA/EIA 606 color code labeling
27. Jacks shall accept snap on icons for identification or designation of applications.
28. Jacks shall be available in 6 colors for identification or designation of applications



at the workstation or telecommunication room.

29. Jacks shall have universal wiring designation.
  30. Jacks shall be marked with the T-568A wiring scheme.
  31. Jacks shall have an attached color coded wiring instruction label housed between the IDC termination towers.
  32. Jacks shall be manufactured in the USA
  33. Jacks shall be designed for 100 Ohm UTP cable termination
  34. Jacks shall be UL LISTED 1863 and CSA certified.
  35. Jacks shall be made by an ISO 9002 Certified Manufacturer.
- D. Design Make: Belden Cat6+
- E. Acceptable Manufacturers:
1. Panduit
  2. Amp
  3. Hubbell

2.03 CATEGORY 6A (625MHZ) 4-PAIR UNSHIELDED TWISTED PAIR CABLE (For WIRELESS)

- A. The horizontal balanced twisted pair cable shall exceed the Category 6A transmission characteristics per issue of ANSI/TIA/EIA 568-C.2 Category 6A. Tested to 625MHz.
- B. Shall be comply with the following:
1. Category 6A - TIA 568.C.2
  2. ISO/IEC 11801 ed 2.1 (2008) Class EA
- C. An ISO 9002 Certified Manufacturer shall make the cable.
- D. Cable shall be UL LISTED.
- E. Physical Characteristics:
1. Cable shall be plenum rated and meet NFPA 262 Plenum Flame Test (UL910)(FT6).
  2. Conductor shall be 23 AWG solid bare annealed copper.
  3. Nominal Outside Diameter - 0.269 in.
  4. Minimum Bend Radius/Minor Axis: 1.200 in.
  5. Minimum Bend/Installation: 2.7 in.
  6. Maximum Pulling Tension - 40 lbs.
  7. Category marking shall be printed every one foot. Footage indicators shall also

be provided on jacket.

8. The color coding of pairs shall be:
  - a. Pair 1 White/Blue Stripe & Blue
  - b. Pair 2 White/Orange Stripe & Orange
  - c. Pair 3 White/Green Stripe & Green
  - d. Pair 4 White/Brown Stripe & Brown

F. Electrical Characteristics Overall

1. Capacitance (pF/ft) – 17.00
2. Nominal Velocity of Propagation: 68.00%
3. Maximum Delay (ns/100 m) - 537 @ 100MHz
4. Typical Delay Skew (ns/ft)- 35
5. Maximum Delay Skew (ns/100 m) – 45
6. Maximum Conductor DC Resistance @ 20°C (Ohm/100 m) – 7.4
7. Maximum Operating Voltage - UL: 300 V RMS
8. Maximum DCR Unbalanced @ 20°C (%) : 3.000

Electrical Characteristics (Continued)

Frequency (MHz)	Input (Unfitted) Imp. (Ohms)	Fitted Impedance	Min. PSACRF (dB)
1	100+/- 15	100+/- 10	68.8
4	100+/- 15	100+/- 10	56.8
8	100+/- 15	100+/- 10	50.7
10	100+/- 15	100+/- 10	48.8
16	100+/- 15	100+/- 10	44.7
20	100+/- 15	100+/- 10	42.8
25	100+/- 15	100+/- 10	40.8
31.25	100+/- 15	100+/- 10	38.9
62.5	100+/- 15	100+/- 10	32.9
100	100+/- 15	100+/- 10	28.8
200	100+/- 22	100+/- 10	22.8
250	100+/- 22	100+/- 10	20.8
300	100+/- 22	100+/- 10	19.3
350	100+/- 22	100+/- 10	17.9
400	100+/- 22	100+/- 10	16.8
450	100+/- 22	100+/- 10	15.7
500	100+/- 22	100+/- 10	14.8
550	100+/- 22	100+/- 10	14.0
600	100+/- 22	100+/- 10	13.2
625	100+/- 22	100+/- 10	12.9
750			11.3
860			10.1

Frequency (MHz)	Min. PSANEXT (dB)	Min. PSAACRF (dB)	Min. TCL (dB)	Min. ELTCTL (dB)
1.000	67.000	67.100	40.000	35.000
4.000	67.000	67.100	40.000	23.000
8.000	67.000	61.100	40.000	16.900
10.000	67.000	59.200	40.000	15.000
16.000	67.000	55.100	38.000	10.900
20.000	67.000	53.200	37.000	9.000
25.000	67.000	51.200	32.000	7.000
31.250	67.000	49.300	35.100	
62.500	66.600	43.300	32.000	
100.000	63.500	39.200	30.300	
200.000	59.000	33.200	27.000	
250.000	57.500	31.200	26.000	
300.000	56.300	29.700	25.200	
350.000	55.300	28.300	24.600	
400.000	54.500	27.200	24.000	
450.000	53.700	26.100	23.500	
500.000	53.000	25.200	23.000	
550.000	52.400	24.400		
600.000	51.800	23.600		
625.000	51.600	23.300		
750.000	50.400	21.700		
860.000	49.500	20.500		

Frequency (MHz)	Max. Attenuation (dB/100 m)	Min. PSNEXT (dB)	Min. PSACR (dB)	Min. RL (dB)
1	2.100	73.3	71.2	20.000
4	3.800	64.3	60.5	23.000
8	5.300	59.8	54.4	24.500
10	5.900	58.3	52.4	25.000
16	7.500	55.2	47.8	25.000
20	8.400	53.8	45.4	25.000
25	9.400	52.3	43	24.300
31.25	10.500	50.9	40.4	23.600
62.5	15.000	46.4	31.4	21.500
100	19.100	43.3	24.2	20.100
200	27.600	38.8	11.2	18.000
250	31.100	37.3	6.3	17.300
300	34.300	36.1	1.9	16.800
350	37.200	35.1		16.300
400	40.100	34.3		15.900
450	42.700	33.5		15.500
500	45.300	32.8		15.200
550	47.700	32.2		14.900
600	50.100	31.6		14.700
625	51.200	31.4		14.500
750	56.700	30.2		14.000
860	61.200	29.3		13.600

G. Applications

1. 10GBASE-T Full Power Implementation (IEEE 802.3an).
2. 10GBASE-T Low Power Implementation (Short Reach Mode) (IEEE 802.3an).
3. 1000BASE-T Applications (IEEE 802.3ab).
4. Power Over Ethernet Plus - 2 pairs, up to 30 Watts or 4-pairs, up to 60 Watts (IEEE 802.3at).
5. Power Over Ethernet - 2 pairs, up to 12.95 Watts (IEEE 802.3af).
6. Broadband Video (CATV) & High Speed Internet (DOCSIS) over UTP up to 860 MHz.
7. High Temperature performance up to 50°C without length de-rating for 1000BASE-T and 100BASE-TX.

H. Design Make: Belden 10GXS13

I. Acceptable Manufacturers:

1. Commscope
2. Berktek
3. Amp

2.04 CATEGORY 6A MODULAR JACKS

A. ETL - Verified Category 6A

B. Performance terminated on a 100M length of cable shall match requirements listed for Category 6A cable

C. Physical Characteristics:

1. Color as determined by owner. Provide different colors for each of the following:
  - a. Wireless Access Points
  - b. Desktop Data and VoIP
  - c. Security
  - d. Wall mounted VoIP
2. Front Connection Flexible PCB with 50u inch Gold over Nickel.
3. Rear Connection IDC Phosphor Bronze with Tin Plating over Nickel.
4. Connector Body N/A Plastic - UL940V-0

D. Mechanical Characteristics:

1. Footprint/Type: KeyConnect
2. Plug / Jack Compatibility: RJ45,
3. Cable/Connector Retention: 15 lbs.

E. Standards Compliance:

1. FCC Part 68, Subpart F
2. IEC 60603-7
3. ISO/IEC 11801:2002 Amendment 2
4. ACA, Bi-national Standard Listed

F. Electrical Characteristics:

Frequency (MHz)	Max. Insertion Loss TIA* (dB)	Max. Insertion Loss Belden** (dB)	Min. NEXT TIA* (dB)	Min. NEXT Belden** (dB)	Min. FEXT TIA* (dB)	Min. FEXT Belden** (dB)
1.000	0.100	0.050	75.000	77.000	75.000	80.000
4.000	0.100	0.050	75.000	77.000	71.100	75.100
8.000	0.100	0.050	75.000	77.000	65.000	69.000
10.000	0.100	0.050	74.000	77.000	63.100	67.100
16.000	0.100	0.060	69.900	72.900	59.000	63.000
20.000	0.100	0.070	68.000	71.000	57.100	61.100
25.000	0.100	0.080	66.000	69.000	55.100	59.100
31.250	0.110	0.090	64.100	67.100	53.200	57.200
62.500	0.160	0.140	58.100	61.100	47.200	51.200
100.000	0.200	0.180	54.000	57.000	43.100	47.100
200.000	0.280	0.260	48.000	51.000	37.100	41.100
250.000	0.320	0.300	46.000	49.000	35.100	39.100
300.000	0.350	0.330	42.900	46.700	33.600	37.600
400.000	0.400	0.380	37.900	42.900	31.100	35.100
500.000	0.450	0.430	34.000	40.000	29.100	33.100
625.000		0.480		37.100		31.200
<b>Mated Connection Table - Footnote: *TIA/EIA-568-B.2-10-2008 Category 6A Standard.</b>						
<b>**Worst-case performance for a 10GX mated connection using 10GX modular plugs.</b>						

Frequency (MHz)	Max. Return Loss TIA* (dB)	Max. Return Loss Belden** (dB)	Min. PSANEXT TIA* (dB)	Min. PSANEXT Belden** (dB)	Min. PSAACRF TIA* (dB)	Min. PSAACRF Belden** (dB)	Min. Balanced TCL TIA* (dB)	Min. Balanced TCL Belden** (dB)
1.000	30.000	34.100	70.500	72.000	67.000	72.000	40.000	45.000
4.000	30.000	34.100	70.500	72.000	67.000	72.000	40.000	45.000
8.000	30.000	34.100	70.500	72.000	67.000	72.000	40.000	45.000
10.000	30.000	34.100	70.500	72.000	67.000	72.000	40.000	45.000
16.000	30.000	34.100	70.500	72.000	67.000	72.000	40.000	45.000
20.000	30.000	34.100	70.500	72.000	67.000	72.000	40.000	45.000
25.000	30.000	34.100	70.500	72.000	67.000	72.000	40.000	45.000
31.250	30.000	34.100	70.500	72.000	67.000	72.000	38.100	45.000
62.500	30.000	34.100	70.500	72.000	67.000	72.000	32.100	39.100
100.000	28.000	30.000	70.500	72.000	67.000	72.000	28.000	35.000
200.000	22.000	24.000	64.500	66.000	61.000	66.000	22.000	29.000
250.000	20.000	22.000	62.500	64.000	59.000	64.000	20.000	27.000
300.000	18.500	20.500	61.000	62.500	57.500	62.500	18.500	25.500
400.000	16.000	18.000	58.500	60.000	55.000	60.000	16.000	23.000
500.000	14.000	16.000	56.500	58.000	53.000	58.000	14.000	21.000
625.000		13.000		56.100		56.100		19.100
<b>Dielectric Strength: 1,000 V RMS @ 60 Hz for 1 minute</b>								
<b>Current Rating: 1.500 A</b>								
<b>Insulation Resistance: 50 M-Ohm Minimum</b>								
<b>Max. Contact Resistance: 20 m-Ohm</b>								
<b>Termination Resistance: 2.5 m -OHM</b>								

G. Design Make: Belden 10GX Modular Jack, Category 6A, RJ45, Key Connect style.

H. Acceptable Manufacturers:

1. Commscope
2. Berktek
3. Amp

## 2.05 CATEGORY 6A UTP PATCH PANELS

A. Characteristics:

1. Steel housing
2. 24 or 48 ports as required by the installation
3. Plug / Jack Compatibility - RJ45
4. Refer to modular jack specification for transmission Characteristics.

B. Standards:

1. FCC Part 68, Subpart F, IEC 60603-7
2. ISO/IEC 11801:2002 Amendment 2

C. Design Make: Belden 10GX Patch Panel - KeyConnect

D. Acceptable Manufacturers:

1. Commscope
2. Berktek
3. Amp

## 2.06 FACE PLATES

A. Provide 106 adapter faceplates.

B. Configured to fit standard single gang outlet box.

C. Rugged and durable ABS plastic construction.

D. UL listed.

E. Acceptable Manufacturers:

1. ICC
2. Belden
3. Panduit

## PART 3 - INSTALLATION

### 3.01 GENERAL

A. Separation from Electromagnetic Interference

Condition	Minimum Separation Distance
Unshielded power lines or electrical equipment in proximity to open or nonmetal pathways.	610 mm (24 in)
Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway.	305 mm (12 in)
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal pathway.	152 mm (6 in)
Electrical motors and transformers.	1194 mm (47 in)

B. Installing cables above suspended ceilings

1. Pull or place cables into the zone pathway.
2. Leave sufficient slack in the ceiling to reach any telecommunications outlet/connector within the zone.
3. Where zone pathways are not provided, divide the floor area into direct-run telecommunications zones.
4. Run all the cables to the center point of their zones.
5. From the center point of each zone, distribute the cables to work areas within that zone.
6. At the center point of each telecommunications zone, support all cables with a cable tie or similar device. Tightly cinched cable ties may have a detrimental effect on transmission performance and should be avoided.
7. Coil in a figure eight any cable that is not in service back to the end of the zone pathway. When required, cable-tie these coiled cables.
8. Label the cables and pathways for easy recognition and establish a working database for ongoing identification and maintenance of horizontal cables and pathways.
9. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 inch intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.

C. Cable raceways shall not be filled greater than the ANSI/TIA/EIA-569-B maximum fill for the particular raceway type.

D. Riser rated cable shall be installed in metallic conduit when installed in a plenum space.

E. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.2 document, manufacturer's recommendations and best industry practices.

### 3.02 UTP CABLE

A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.2 document, manufacturer's recommendations and best industry practices.



- B. All wiring concealed in new walls or soffits shall be installed in metal conduits.
- C. Wiring in existing walls with hollow cavities may be installed loose.
- D. All exposed wiring shall be installed in surface metal raceway.
- E. All wiring above ceilings shall be installed in cable tray or open top cable hangers and brackets.
- F. Cable hangers above accessible ceilings shall be installed 4' on center attached to building structure. If cables have more than 12" of sag, install more hangers.
- G. Do not untwist cable pairs more than 0.5 in. when terminating.
- H. The Contractor shall be responsible for replacing all cables that do not pass required bandwidth and throughput tests.
- I. Maximum length shall be 90 meters. (295 ft).
- J. Maximum patch cable shall be 5 meters (16 ft).
- K. Provide 10 ft service loop in the communications equipment room. Provide 3 foot service loop in ceiling above outlet. Slack should not be stored in bundled loops. Cable loops have had a degrading effect on cabling performance. Cable slack should be stored in an extended loop or in a figure-eight configuration to alleviate stress.
- L. Cable shall have no physical defects such as cuts, tears or bulges in the outer jacket. Cables with defects shall be replaced.
- M. Install cable in neat and workmanlike manner. Neatly bundle and tie all cable in closets. Leave sufficient cable for 90o sweeps at all vertical drops.
- N. Do not tie-rap cable to a perpendicular support. Tie-raps shall be used to secure cables to other like cables or to an approved tie mount. Do not over tighten cable ties.
- O. Install category 6 cable in a separate open cable hanger segment. Do not install with coaxial, optical fiber cable or any other cable type. If cables have more than 12" of sag, install more hangers.
- P. Do not install UTP cable with more than 110N (25 lbs) pull force, as specified in EIA/TIA and BICSI TDDM practices. Utilize appropriate cable lubricant in sufficient quantity to reduce pulling friction to acceptable levels on: long pulls inside conduit, pulls of multiple cables into a single small bore conduit, on conduit runs greater than 100 lineal feet with bends of opposing directions, and in conduit runs that exceed 180 degrees of accumulated bends. Use of tensile rated cords (i.e. fishing line) should be used for difficult or questionable pulls - to judge to go/no-go condition of the conduit and pulling setup.
- Q. Care must be taken so that the cable does not bend at any location to a radius less than ten times the diameter of the cable. A cable feeder guide of suitable dimensions should be used between the cable reel and the face of the duct to protect the cable and guide it into the duct as it is payed off the reel.
- R. As the cable is payed off the reel, it should be carefully watched and inspected for sheath defects. If defects are noticed, the pulling operation should be stopped immediately and

the Engineer promptly notified of the defect. Kinks and/or other irregularities in the cable sheath should be removed or corrected as directed by the engineer.

- S. A plastic or nylon pull cord with a minimum test rating of 90 Kg (200 lb.) shall be co-installed with all cable installed in any conduit.
- T. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.
- U. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
- V. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the Contractor shall install appropriate carriers to support the cabling.
- W. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Owner.
- X. Leave a minimum of 12" of slack for twisted pair cables at the outlet. Cables shall be coiled in the in-wall box, surface-mount box or modular furniture raceway if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. In hollow-wall installations where box-eliminators are used, excess wire can be stored in the wall. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.
- Y. Cables shall be neatly bundled and dressed to their respective termination device. Each terminating device shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
- Z. Each cable shall be clearly labeled on the cable jacket behind the termination device at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

### 3.03 UTP Modular Jacks

- A. All cables shall be terminated with modular jacks that snap into a faceplate mounted on a wall outlet box, surface raceways or power pole.
- B. Outlet boxes shall be secured to building with mechanical fasteners. Adhesive fasteners are not allowed.
- C. Jacks shall be installed to provide minimal signal impairment by preserving wire pair twists as close as possible to the point of mechanical termination. The amount of untwisted in a pair as a result of termination to the jack shall be no greater than 0.5 inches (13mm).
- D. Jacks shall be installed according to manufacturer's instructions and properly mounted in plates, frames, housings or other appropriate mounting device.

- E. Jacks shall be installed such that cables terminated to the jacks maintain minimum bend radius of at least 4 times the cable diameter into the IDC contacts. Cables shall be terminated on jacks such that there is no tension on the conductors in the termination contacts.
- F. All extra openings to be filled with blank inserts.
- G. Terminate cable per EIA/TIA T-568B standard pin assignments.
- H. Remove only as much cable jacket as is required for termination and trimming. Follow the manufacturer's instructions for mounting, termination, and cable management. Minimize the amount of untwisting in a pair as a result of termination to connecting hardware. For untwisting cabling, maintain pair twists as close as possible to the termination point. The amount of untwisting must not exceed 12.7 mm (0.5 in) for category 5e and higher cables.

### 3.04 Completion and Acceptance

- A. In all spaces that have had floor or wall penetrations, hammer drilling, or core boring activities - a thorough brooming, vacuuming, and wet mopping/sponging shall be preformed. Cleaning shall include floors, walls, ladder trays, tops of cabinets/racks, existing/new passive and active components, per manufacturer recommendations.
- B. Submit copies of the following:
  - 1. Cable Test Reports (at substantial completion).

### 3.05 PATCH PANELS.

- A. Panels shall be installed to provide minimal signal impairment by preserving wire pair twists as closely as possible to the point of mechanical termination. The amount of untwisting in a pair as a result of termination to the patch panel shall be no greater than 0.5 inches (13 mm).
- B. Panels shall be installed according to manufacturer's instructions and properly mounted to a rack, cabinet, bracket or other appropriate mounting device.
- C. Panels shall be installed such that cables terminated to the panel can maintain minimum bend radius of at least 4 times the cable diameter into the IDC contacts.
- D. Cables shall be terminated on the panels such that there is no tension on the conductors in the termination contacts. Panels shall be properly labeled on front and back with the cable number and port connections for each port, as per cable schedule drawings.
- E. All cables shall be neatly "dressed out" in equipment rooms. Cables to be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
- F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within a bundle, where the label is obscured from view shall not be acceptable.

- G. Install factory supplied patch panel labels, in the corresponding T568B configuration, in all UTP patch panels, BEFORE beginning to terminate cables. Cables terminated onto a patch panel without said port label strip shall not be acceptable.
- H. The cable jacket shall be maintained as close as possible to the termination point.

### 3.06 COLOR CODING

- A. Prior to submitting cable and connector cuts for approval confirm with the owner's IT director the required cable and jack colors.
  - 1. Data Cable and Jacks – Blue
  - 2. Wireless Data Cable and Jacks – Green
  - 3. Security Data Cable and Jacks – Orange

### 3.07 CEILING TILES

- A. The cabling contractor shall replace all ceiling tiles that are damaged due to cable installation. Tiles shall match the existing.
- B. Prior to beginning work walk the proposed cable routes and document any existing damage with the construction manager.

### 3.08 ATTACHMENT CABLES:

- A. Attachment cable assemblies, for use between workstation and room data connector, attenuation requirements ANSI/TIA/ EIA-568A, ISO9001, ISO/IEC 11081. Cables shall be Category 6, 24 AWG stranded conductors, #RJ45 connectors at each end.
- B. Contractor shall furnish (1) attachment cable for each room data drop, cable length shall be as noted below unless noted otherwise on Drawings.

	Length
Classroom (Standard Rm.)	8'-0"
Computer Classroom	8'-0"
Library	8'-0"
Office/Administrative Areas	7'-0"

- C. Note: Provide any additional attachment cables with strain relief boots for completion. Refer to Technology Room Layouts on Contract Drawings for quantity and length required.

### 3.09 CABLE IDENTIFICATION:

- A. All cables terminated in classrooms and wiring closets shall be identified with laser wire markers. Wire markers shall be factory printed on vinyl cloth or film with a self-adhesive, self-laminating wrap or permanent locking cable tie. Wrap type markers shall be minimum 1-1/2" long.
- B. Contractor shall submit to Engineer product data and samples of wire markers intended for use on this project.

- C. Cable identification shall be 6 digit numbers corresponding to wiring closet, patch panel, port number and drop number, refer to Drawing Legend.
- D. Furnish Laser Printable Labels (PLL) with lamination Panduit Co.; or equal.
- E. Identification numbers hand written by marking pen directly on cable jacket are not acceptable!!!
- F. Wrap type markers shall be completely wrapped around cable OD. Application of markers using "tabbed" or "flagged" methods are not acceptable.

END OF SECTION 271500



## SECTION 272000 – DATA COMMUNICATIONS

### PART 1 - CODES, STANDARDS, AND REGULATIONS

- 1.1 Communication design shall comply with Federal and State codes, regulations, and standards with variances adopted as standards by the NJSDA. Applicable state and national standards include the latest editions of:
- A. ANSI/NFPA 70 National Electrical Code with New Jersey Amendments
  - B. BICSI CO-OSP Customer Owned Outside Plant Manual
  - C. BICSI 12th Edition Telecommunications Distribution Methods Manual
  - D. BICSI 3rd Edition Customer Owned Outside Plant Design Manual
  - E. EIA Standard EIA-230 - Color Marking of Thermoplastic Wire
  - F. FCC Rules and Regulations:
    - 1. J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications National Electrical Safety Code
    - 2. NFPA 101: Life Safety Code REA Standards for Engineering, Construct
    - 3. TIA 526-14-A Optical Power Loss Measurements for Installed Multimode Fiber Cable Plant-OFSTP-7
    - 4. TIA 568-C Commercial Building Telecommunications Cabling
    - 5. TIA 569-B Commercial Building Standard for Telecommunications Pathways and Spaces
    - 6. TIA Standard ANSI/TIA/EIA-607-A - Commercial Building Grounding and Bonding Requirements for Telecommunications
    - 7. TIA 604 Standards on Fiber Optic Connector Intermateability
    - 8. TIA 606-A Administration Standard for Commercial Telecommunications Infrastructure Standard
    - 9. TIA 758-A Customer Owned Outside Plant Telecommunications Cabling Standard
    - 10. TIA Telecommunication Systems Bulletin TSB67 - Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems
    - 11. TSB-140 Additional Guidelines for Field Testing Length, Loss and Polarity of Optical Fiber Cabling Systems
    - 12. In the event of a conflict between the Electrical Standards (D50, D60 and D70) and other guidance documents, the Education Specifications, the SDA's Kit of Parts, Bridging Documents also known as the Design Builder's Information Package and presiding codes shall take precedence.
- 1.2 Data Communications Network Equipment/Design Approach:
- A. Main Distribution Frame (MDF) / Intermediate Distribution Frame (IDF) Description:
    - 1. Main Distribution Frame (MDF) - A Main Distribution Frame shall be provided to distribute connectivity to the IDF, station cabling as required and to house the main control equipment of the following systems:
      - a. Local Area Network
      - b. Wide Area Network
      - c. Carrier/Service Provider Interconnections
      - d. Telephone System

- e. Paging/Intercom System
  - f. Clock Systems
  - g. Internet Protocol Digital Video Surveillance (IPDVS) System
  - h. Digital Video Distribution System
  - i. Building Management System
2. Any station cabling that does not exceed 80-Meters (262 Feet) in length shall be homerun to the Main Distribution Frame.
  3. Intermediate Distribution Frame (IDF) - Intermediate Distribution Frame shall be provided to distribute core connectivity from the MDF to station cabling where cable distances exceed 80-Meters (262 Feet) to the MDF
  4. The designated MDF shall have a single room UPS capable of supporting all devices within the room for up to three hundred (300) seconds (five (5) minutes) of operation at full capacity. Ability to manage and view UPS statistics via IP Based connectivity.
  5. For room based UPS Systems a bypass mode shall be included and must provide an alternate path for utility power to the connected load in the event of planned maintenance activities or a UPS malfunction.
  6. IDF's and Server cabinets outside of the MDF with access to building generator power shall have rack based UPS systems capable of supporting all devices within the rack/cabinet for up to three hundred (300) seconds (five (5) minutes) of operation at full capacity. Ability to manage and view UPS statistics via IP Based connectivity.
  7. IDF's and Server cabinets outside of the MDF with access to building generator power shall have rack based UPS systems capable of supporting all devices within the rack/cabinet for up to three hundred (300) seconds (five (5) minutes) of operation at full capacity. Ability to manage and view UPS statistics via IP Based connectivity.
  8. All server cabinets housed in the MDF shall have 48 Port Category 6 Compliant 110- type rack-mounted patch panels provided on the "rear" of the cabinet. This panel shall terminate on a 2 post telecom/network rack to supply network connectivity for devices inside the cabinets.
  9. Controlled access to the Main Telecommunications Room and Intermediate Telecommunications Closet shall be provided. This can be accomplished with a lock, card reader or other approved mechanism.
  10. The Main Telecommunications Room shall be built in accordance with "DCA Best Practices Standards for Schools under Construction or Planned for Construction."

B. Routing – at a Minimum Routers Must Support:

1. Open Shortest Path First (OSPF)
2. Enhanced Interior Gateway Routing Protocol (EIGRP)
3. Routing Information Protocol (RIP), and RIPv2
4. Two (2) - 10/100/1000-T Copper based
5. One (1) - Small form-factor pluggable (SFP) based slot
6. Four (4) - Enhanced High-Speed WAN Interface Cards (EHWIC)
7. Three (3) Digital Signal Processors (DSP) slots
8. One (1) Internal Services Module (ISM) slot
9. Flash: Support up to 4 GB (Gigabytes)
10. RAM: Support up to 2.5 GB (Gigabytes)
11. RJ-45 Console serial port and USB Console Serial Port
12. Management Capabilities via IP / SNMP / Telnet / SSH / HTTP(S)



C. Switching - at a Minimum Switches Must Support:

1. MDF – A core switch housed within the MDF must meet these minimum requirements:
2. Modular Chassis Switch with 7, 9 or 13 Slots
3. Supervisor engine redundancy
4. 19" (19-inch) rack compatible
5. Redundant 4200W Power Supply
6. IEEE 802.3af/at compliant PoE/PoEP
7. Hot swappable
8. 280-Gbps (Gigabits per second) switching capacity
9. IP routing protocols: Enhanced Interior Gateway Routing Protocol (EIGRP), Open Shortest Path
10. First (OSPF), Routing Information Protocol (RIPv2)
11. IEEE 802.1Q VLAN Encapsulation 12. 802.1s, 802.1w, 802.3ad
12. 13. 802.3af/at (PoE)
13. Ether Channel bonding across line cards
14. Port Aggregation Protocol (PAgP)
15. Voice VLAN and VLAN ID (VVID)
16. Jumbo Frames (up to 9216 bytes)
17. Traffic Storm Control and/or Broadcast/Multicast Suppression
18. Bridge Protocol Data Unit (BPDU) Guard
19. Link Layer Discovery Protocol (LLDP)
20. Switches housed in MDF and IDF rooms support 10 Gigabit Ethernet Connectivity between IDF and MDF rooms. 1-Gigabit Ethernet Connectivity to each station drop.

D. IDF - Switches Housed Within the IDF Must Meet These Minimum Requirements:

1. Stackable with each node member switch being able to serve as a master, creating a 1:N availability scheme for network control.
2. Inter-connection via a channel or bus cable
3. 1100W (minimum) Power Supply
4. Power over Ethernet (PoE) capable on all copper based ports. 802.3af and 802.3at Standards
5. All ports must support 1-Gigabit Ethernet connectivity
6. IP routing protocols: Enhanced Interior Gateway Routing Protocol (EIGRP), Routing Information Protocol (RIPv2)
7. Wireless Data (Wi-Fi) Communications System - A wireless access network shall span all occupy able spaces through the entire facility.
8. Must utilize a centralized controller that allows management of wireless network as a whole.
  - a. Allow for management of individual access points.
  - b. Application of site wide wireless access policies.
9. Shall be capable of providing:
  - a. IEEE 802.11a, 802.11b, 802.11g, 802.11n, 802.11ac
  - b. Encryption WEP and TKIP-MIC; SSL and TLS; AES (CCM, CCMP)
  - c. Authentication, Authorization, and Accounting (AAA); IEEE 802.1X; RADIUS; PPP EAP-TLS; Extensible Authentication Protocol (EAP) with RADIUS
10. Wireless Node Isolation.
11. IEEE 802.1Q VLAN tagging; intra-VLAN security; VLAN Isolation

## PART 2 - VOICE COMMUNICATIONS

### 2.1 Telephone System Description

#### A. General

1. The intent is to provide a school wide Voice over IP (VoIP) Telephone System with voicemail capabilities. The Telephone System and the Data Systems shall share physical cabling mediums and strive for maximum integration.

#### B. Equipment and Locations

1. All processing and head end systems required for voice communications shall be housed in the Main Distribution Frame (MDF) room.
2. Telephones outlet and handset shall be provided in all administrative areas, class rooms, offices, security desks and other specified locations.
3. Wall telephone outlet without lock box and handset shall be provided in utility rooms, storage rooms greater than 200 sq. ft., mechanical rooms, elevator machine room, supply rooms and vault room.
4. Dedicated phone lines (not through the IP Private Branch Exchange (PBX)) shall be provided for the Intrusion Alarm System, Fire Pump, and Elevator Intercom System.
5. A loud Bell is to be placed in noisy areas including the auditorium, gymnasium, gymnasium, student cafeteria, kitchen and the boiler room. A loud bell may be required in other noisy areas; however, this will be addressed on a case by case basis and will be determined by the contract documents.

## PART 3 - VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT

### 3.1 Internet Protocol Private Branch Exchange (IP PBX) Minimum Requirements

- A. H.323 and SCCP protocol support
- B. IP Based SIP, Digital (PRI / BRI) and POTS line carrier interface (Trunk)
- C. Analog Telephone Adaptor (ATA)/ Foreign eXchange Subscriber (FXS) Adapter support up to 20 line appearances per phone
- D. Support of fallback service phone auto-registration
- E. IP Handsets; Software phone client.
- F. Foreign eXchange Office (FXO) interface for analog systems.
- G. E911 with two emergency location numbers per zone; unlimited zones per site
- H. Paging: Internal through IP phones or to external paging system
- I. Ad-hoc conferencing
- J. Push Button intercom and Night Bell capabilities.
- K. Multiple music-on-hold (MoH) streams (internal/external)

## PART 4 - VOICE COMMUNICATIONS TERMINAL EQUIPMENT

### 4.1 Telephone Set Type: Minimum Capabilities, Requirements

#### A. Executive/Administrative offices

1. Six (6) Physical Lighted Line Appearance keys
2. Two way Speaker Phone
3. Support for expansion module with additional line keys
4. 802.3af Power Over Ethernet (PoE) support.
5. Integrated 10/100 switch.

#### B. Classroom / Shared Spaces

1. Two (2) Physical Lighted Line Appearance keys
2. Two way Speaker Phone
3. 802.3 af Power Over Ethernet (PoE) support.
4. Integrated 10/100 switch.

#### C. Public areas / Miscellaneous Spaces

1. 1 line (May use 0 line keys)
2. 802.3 af Power Over Ethernet (PoE) support.

#### D. Conference Rooms / Conference Phones

1. Support for external microphone kit
2. 802.3 af Power Over Ethernet PoE support.
3. Door Phone / Push button Intercom
4. Door Intercom w/ doorstrike release
5. Vandal resistant / Hardened
6. Phone system integrated

### 4.2 Elevator Intercommunication System

- A. Elevator car stations shall have an auto-dialer and a time-clock switch programmable to dial primary and secondary numbers.
- B. Connect the automatic dialing, hands-free station in the elevator car to a dedicated telephone line. The elevator car station shall automatically dial a programmed number to alert the school personnel that there is a problem in the elevator and identify visually which elevator is initiating the call.
- C. The primary number shall ring in the General Office, while the secondary number shall ring the elevator installer. Dedicated phone lines (not through the Private Branch Exchange (PBX)) shall be provided for the Elevator Intercommunication System
- D. Provide a telephone set within Elevator Machine Rooms, as part of school telephone system.

END OF SECTION 272000



## SECTION 272100 – DATA COMMUNICATIONS NETWORK EQUIPMENT

### PART 1 - GENERAL GUIDELINES

#### 1.1 GENERAL

- A. This Section defines the general design requirements for a uniform Data Communications Network Infrastructure

#### 1.2 SECTION INCLUDES

- A. DATA COMMUNICATIONS NETWORK EQUIPMENT

- 1. File/Building Server – optional.
  - 2. Network Switches.
  - 3. Network Core Switch.
  - 4. Network Security Equipment.
  - 5. Uninterruptible Power Supplies (UPSs).

#### 1.3 QUALITY ASSURANCE

- A. All equipment shall be UL listed.
- B. All equipment and Installation Practices shall comply with the latest ®BICSI Telecommunications Distribution Methods Manual (TDMM).

#### 1.4 SYSTEM WARRANTY

- A. The Local Area Network Electronics and software shall be fully warranted for three (3) years from date of substantial completion by the contractor and manufacturer. If any defects are found within this warranty period, the defective system component shall be replaced at no extra cost to the Authority for parts or labor. Provide a statement of this warranty with the O&M manuals and to the Director of IT. Make available a service contract offering continuing factory authorized service of this system after the initial warranty period.

#### 1.5 GENERAL

- A. Each Building shall be provided with a Local Area Network (LAN) System.
- B. Existing Facilities that are being remodeled shall be upgraded to the current requirements stated herein.
- C. Single Building projects shall be compatible with the existing network infrastructure.
- D. Wide Area Network (WAN) Interfaces shall be provided to interface the Authority's WAN provider. Coordinate WAN requirement with the Authority's fiber provider as applicable.
- E. Buildings shall be designed as to minimize the quantity of Telecommunications Rooms and to centralize as much of the Data Network Equipment as possible.
- F. Multiple buildings on the same campus should be designed to share common Data Network Electronics and equipment wherever possible.

- G. The Authority should design their Data Networks to take advantage of Centralization of Common Network Equipment at a Network Operations Center(s).
- H. Items that should be centralized include:
  - 1. File/Building Servers.
  - 2. L-3 Routing Devices.
  - 3. Network Management Equipment.
  - 4. Security Devices, Radius Servers, etc.
  - 5. WAN access equipment.
  - 6. Wireless Management Equipment.
- I. As a minimum, the Network may be used to support the following applications on a Local and Wide Area basis:
  - 1. Automation Systems.
  - 2. Clock Systems.
  - 3. Control Systems.
  - 4. Data Networking
  - 5. Security Systems.
  - 6. Video Conferencing.
  - 7. Video Streaming/Media Retrieval.
  - 8. VoIP Telecommunications.
  - 9. Wireless Access Points.

#### 1.6 FILE/BUILDING SERVER

- A. Provide Network File/Building Server for the central administration and storage of computer files and information. The Networked Server shall be of a current design criteria, utilizing SAS 10k-15k rpm RAID level 5 hard drive storage (minimum 2TB)--Quad core processor. Coordinate OS with the Authority. Min. 64-bit Windows Server 2008 if Windows based. Minimum 16 GB of RAM, 2 x 10Gig NIC. Attach to Core via 10 Gig DAC. 22" LED monitor, rack mounted.
- B. Provide Operating System based on the Authority's requirements.

#### 1.7 NETWORK SWITCHES

- A. Proprietary Specifications:
  - 1. The following product/manufacture has been approved by the Authority for proprietary specifications and use in this project.
    - a. Network Switches: Cisco
  - 2. Subject to compliance with codes and all project requirements, the Contractor is required to use the indicated product/manufacture and to verify compatibility with the existing systems.
- B. Provide 1000 Base T Layer 2 Manageable Ethernet Switches with ports in a quantity to support all initially planned devices, including wireless access points, with 15% spare.
- C. Provide a configuration of switch ports utilizing either stackable edge switches or a modular chassis with single engine and dual PS.
  - 1. Provide dual 10GB uplinks to each switch stack or modular chassis.

- D. The 1000 switches shall be “non-blocking” and support a minimum forwarding bandwidth equal to the number of switch ports x 1 Gbps.
- E. Utilize 10GB uplinks for all uplinks. Switches may be stacked, but provide each stack with a minimum of two uplinks for redundancy.
- F. Chassis mounted units are acceptable for Edge Switches, provided that dual power supplies and equivalent uplink bandwidth is supplied.
- G. The Network switches shall support advanced services such as:
1. IP Telephony.
  2. Wireless Access Points.
  3. Building Management Systems.
  4. Video Streaming.
  5. IP CCTV/Access Control
- H. POE+ switches shall be rated to provide POE+ class 3 on all ports simultaneously. Standard 30 watts per port. Reference 802.3at standard.
- I. The 1000 switches shall support the following features and specifications:
1. 1000BASE-LX/LH.
  2. 1000BASE-SX.
  3. 1000BASE-X (SFP).
  4. 1000BASE-ZX.
  5. Access Control Lists (ACL).
  6. Advanced QoS.
  7. IEEE 802.1s.
  8. IEEE 802.1D Spanning Tree Protocol.
  9. IEEE 802.1p CoS Prioritization.
  10. IEEE 802.1Q VLAN.
  11. IEEE 802.1s.
  12. IEEE 802.1w.
  13. IEEE 802.1x.
  14. IEEE 802.3 10BASE-T specification.
  15. IEEE 802.3ab 1000BASE-T specification.
  16. IEEE 802.3ad.
  17. IEEE 802.3af and 802.11at POE.
  18. IEEE 802.3u 100BASE-TX specification.
  19. IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports.
  20. IEEE 802.3z 1000BASE-X specification.
  21. IPv6.
  22. Rapid Spanning Tree.
  23. Rate Limiting.
  24. RMON I and II standards.
  25. SNMPv1, SNMPv2c, and SNMPv3.
- J. Provide sufficient 1000 ports to accommodate, as a minimum, the following devices as required:
1. Access Control System.
  2. Admin PCs.
  3. Classroom PC Devices.
  4. Clock Systems.

5. Distant Learning Systems.
  6. Instructor PCs.
  7. Monitor/TVs, as required.
  8. MPEG Encoders.
  9. PABX System.
  10. Printers.
  11. Projectors.
  12. Set Top Boxes, as required.
  13. UPS Units.
- K. Provide all GB POE+ ports to accommodate, as a minimum, the following devices as required:
1. IP Phones
  2. IP CCTV Cameras
  3. WLAN access points.
- L. Switches housed in MDF and IDF rooms support 10 Gigabit Ethernet Connectivity between IDF and MDF rooms. 1-Gigabit Ethernet Connectivity to each station drop.

## 1.8 NETWORK CORE SWITCH

- A. Provide a modular chassis-based central Layer-3 ethernet routing switch with advanced QoS to serve the entire building or campus. The Core switch shall be provided with backplane capacity to provide full non-blocking support of all installed line cards plus 15% growth.
- B. Equip the Central Layer-3 switch with a minimum of two (2) Power Supplies and two (2) Redundant Central Control/Supervisor Units.
- C. All Core switch Blades must support full line speed and shall not be over-subscribed.
- D. Provide sufficient Ports on the Layer-3 Core Switch, as a minimum, for the following devices:
1. Provide Network Switch uplink ports to support all edge switches plus 15% spare. The switch shall have at least one spare uplink card for redundancy.
  2. Building Automation Systems, as required (typically TX).
  3. CCTV DVR System (typically TX).
  4. File Servers (typically TX, 10GB).
  5. Firewall, as required (typically TX).
  6. Media Distribution Servers & Controllers (typically TX).
  7. Radius Authentication Server, as required, (typically TX).
  8. WAN Connectivity (typically LX or CWDM).
  9. Wireless Controllers (typically TX, 10GB).
  10. Wireless Phone Controller (typically TX).
  11. Wireless Control Console (typically TX).
- E. In addition to the above listed features and specifications for the Network Switches, the Network Core Switch shall support the following Features and Specifications:
1. 10 Gbps Support capabilities.
  2. BGP4 and Multicast Border Gateway Protocol (MBGP).
  3. Full Internet Control Message Protocol (ICMP) support.



4. Hot Standby Router Protocol (HSRP).
5. ICMP Router Discovery Protocol.
6. IGMP filtering.
7. IGMP v1, v2, and v3.
8. IP Multicast routing protocols.
9. IP routing protocols: EIGRP, OSPF, Routing Information Protocol (RIP), and RIP2.
10. Non-Blocking GBE Ports.
11. NSF awareness.
12. Policy-based routing (PBR).
13. Virtual Router Redundancy Protocol (VRRP).

## 1.9 NETWORK SECURITY EQUIPMENT

### A. RADIUS SERVER

1. If the Authority does not have a Central Radius Server, provide a Radius Server for Network Authentication, VLAN Assignment and Policy Assignment for IP Network Attached Devices.

### B. FIRE WALL

1. If the Authority does not have a Central Firewall and Intrusion Detection Device for connection to the Wide Area Network and Internet, provide a Firewall and Intrusion Detection Device for Protection and Security. Establish all Internet Connections via a Firewall.
2. Size the Firewall based on planned Network throughput, available WAN bandwidth and attached IP Devices.
3. Provide VPN services in the Firewall for remote access and network maintenance services.
4. Coordinate requirements with the Authority's Technology Department.

## 1.10 UNINTERRUPTIBLE POWER SUPPLIES (UPSs)

- A. Provide Dual Conversion UPS units for ER and TR Local area Network Electronics and File Server, providing sufficient protection from power anomalies.
- B. Provide Power strips, connected to the UPS Unit via twist-lock plugs. Locate the power strips in the equipment racks and on the equipment backboards for powering all electronics systems in the ER and TRs.
- C. Provide multiple UPS Units based on expected power load or a single large UPS Unit. Locate the multiple UPS units in the associated equipment racks or locate a larger central UPS unit in the Room.
- D. Connect the UPS Units to Building Emergency Generator when available.
- E. For buildings without a Generator, supply a two-hour (2) standby.
- F. Provide shutdown connections from the UPS to servers for graceful power down in the event of a power failure.
- G. Equip the UPS Units with a twist-Lock Power cable and SNMP Management Card.
- H. Connect the UPS SNMP Management to the Management VLAN.

- I. Coordinate UPS voltage, circuit size, and connection requirements with the Electrical Design Professional.

#### 1.11 INSTALLATION

- A. Install File Server (optional) and setup basic user accounts and network configuration.
- B. Install Data Network Ethernet Switches and validate connectivity throughout. Establish all VLANs, QoS, IP Routing and IP Subnets.
- C. Consult with the Authority and consider providing the following VLANs as a minimum:
  - 1. Administration.
  - 2. HVAC.
  - 3. Management.
  - 4. Point of Sale.
  - 5. Student.
  - 6. Video.
  - 7. Voice.
  - 8. Wireless.
  - 9. Security, CCTV
- D. Coordinate network installation and integration with other systems connected to the network with the Authority's and applicable DA-Site's technical and operational requirements.
- E. Install and setup UPS units and establish power down procedures.

#### 1.12 LABELING AND MARKING

- A. Provide a typed schedule of all data ports according to each related room jack designation for all TRs, and ER, in accordance with the Authority's requirements.

#### 1.13 TESTING

- A. Test the system "end-to-end" (from TR to ER, and from TR to station jack) at the direction of the Design Professional and verify, in writing, that the data network system is in proper working condition.
- B. Verify and demonstrate proper operation of all switches, Access Points, VLANs, Routing, WAN Connectivity and possible ATM Connectivity with the Authority's and DA-Site representative, if applicable.

#### 1.14 TRAINING

- A. Provide a minimum of forty (40) hours of training to the Authority's personnel. Plan for multiple training trips to the site. Training session(s) shall cover the following topics at a minimum:
  - 1. System Equipment Connectivity
  - 2. Device Configurations
  - 3. Operation, maintenance, and upgrade procedures.
- B. Training to be arranged with Authority personnel. 40 hours should be spread out over

the length of the warranty (Ex: 8 hours at project turnover/completion, 8 hours at 3 months, 8 hours at 6 months, 8 hours at 1 year, 4 hours at 2 years, 4 hours at 3 year).

- C. Training to occur in maximum of 2 hour increments per personnel or groups of personnel.
- D. Consider requiring Contractor to provide manufacturer training vouchers for a portion of the training, which are valid during the warranty period.
- E. Training shall be by certified manufacturer instructor.
- F. Training schedule shall be coordinated with Authority personnel and their needs.
- G. Training plan, time line, and agenda shall be provided to Authority IT personnel and signed off by the Authority and Contractor.
- H. Warranty certificate and agreement shall be provided to Authority IT personnel at initial training session.
- I. Provide a digital video copy of the training sessions.

END OF SECTION 272100



## SECTION 272102 – DATA SYSTEMS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This Section includes the cable, network switches, connecting devices, wireless access points, patch panels, installation, and testing for wiring systems to be used as signal pathways for video and high-speed data transmission.
- B. One system integrator shall oversee all installations related to this specification and related documents listed in part 1.1.

#### 1.03 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each component specified, including detailed manufacturer's specifications. Include data on features, ratings, and performance. Include dimensioned plan and elevation views of components. Show access and working-space requirements.
- C. Samples of Data outlet connectors, jacks, jack assemblies, and faceplates and evaluation of technical features.
- D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Provide evidence of applicable registration or certification.
- E. Field test and observation reports indicating and interpreting test results relative to compliance with performance requirements of the installed systems.
- F. Maintenance data for products to include in the operation and maintenance manual.

- G. Final Documentation as specified in Part 3.
- H. Evidence of listing of products specified to be listed in the "Quality Assurance" Article.
- I. Shop Drawings:
  - 1. Provide (3) sets of documents on cable certification results and AutoCAD files indicating cable location, labels and all connections.
- J. Extra Materials: Submit one month prior to date of Substantial Completion.
- K. Provide certification for Owner's maintenance personnel as verification of training.

#### 1.04 QUALITY ASSURANCE

- A. Installing Firm Must Be A Qualified Cabling Contractor With At Least Five Years Experience In The Installation, Testing And Adjustment Of Systems Similar To The System Specified Herein.
- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
  - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
  - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- C. Work Coordination: Coordinate Work of this Section with Owner's telephone switch, telephone instrument, workstation, local area network (LAN), and wide area network (WAN) equipment suppliers. Coordinate the service entrance arrangement with the local exchange carrier.
  - 1. Meet jointly with representatives of the above organizations and Owner's representatives to exchange information and agree on details of equipment arrangements and installation interfaces.
  - 2. Record agreements reached in meetings and distribute record to other participants.
  - 3. Adjust the arrangements and locations of distribution frames and patch panels in equipment rooms and wiring closets to accommodate and optimize the arrangement and space requirements of the telephone switch, LAN and WAN equipment.

#### 1.05 WARRANTY

- A. Fifteen (15) year manufacturer's product warranty and 15-year performance warranty for all wiring system components, in writing directly from the manufacturer to the customer, and copied to the engineer. The performance warranty shall warrant the installed cabling system including data cables and fiber optic cables. Copper links shall be warranted against the link performance minimum expected results defined in TIA/EIA 568, tsb-67. Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in the TIA/EIA 568, Annex h.

## 1.06 STANDARDS

- A. All data and video cabling work must comply with federal, state and local codes. Any code or requirement found to be more stringent than in these contract documents shall take precedence over the contract documents, and will become a contract requirement. Contractor must identify and report any deviations being considered from the following standards:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA):

EIA/TIA-568 -- COMMERCIAL BUILDING CABLING STANDARDS AND IEEE 802.3X.

EIA/TIA-569-- COMMERCIAL BUILDING STANDARDS FOR TELECOMMUNICATIONS PATHWAYS AND SPACES.

EIA-TSB36—(TECHNICAL SYSTEMS BULLETIN 36) FOR CABLE SPECIFICATIONS.

EIA/TIA-TSB 67-TECHNICAL SYSTEMS BULLETIN 67)-- TESTING STANDARDS.

EIA/TIA-TSB 72—(TECHNICAL SYSTEMS BULLETIN 72)--CENTRALIZED OPTICAL FIBER CABLING.

EIA/TIA-TSB 75—(TECHNICAL SYSTEMS BULLETIN 75)--OPEN OFFICE CABLING.

EIA/TIA-606 ADMINISTRATION STANDARDS FOR TELECOMMUNICATIONS INFRASTRUCTURE.

EIA/TIA-607—COMMERCIAL BUILDING GROUNDING AND BONDING REQUIREMENTS FOR

TELECOMMUNICATIONS.

EIA/TIA-TSB40A (TECHNICAL SYSTEMS BULLETIN 40A)-- ADDITIONAL TRANSMISSION SPECIFICATIONS FOR UNSHIELDED, TWISTED-PAIR CONNECTING HARDWARE.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA).

NFPA NUMBER 70.

NFPA ARTICLE 725-- REMOTE CONTROL, SIGNALING AND POWER-LIMITED CIRCUITS.

NFPA ARTICLE 800-- COMMUNICATIONS CIRCUITS.

NFPA ARTICLE 770—OPTICAL FIBER CABLES.

UNDERWRITERS LABORATORIES INC (UL).

UL 910—TEST METHOD FOR FIRE AND SMOKE CHARACTERISTICS OF ELECTRICAL AND OPTICAL-FIBER CABLE.

#### 1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

1. Data Cable: 1000 feet size and type used for Project. Furnish on reels.
2. Patch Cords: (10) of each type and length used for Project.
3. Station Cables: (10) of each length used for Project.
4. Connecting Blocks: 1 of each type for each 100 installed, but not less than 1.
5. Faceplate./Jack Assemblies: (10) of each type for each 100 installed, but not less than 1.

#### 1.08 DELIVERY, STORAGE AND HANDLING

A. Fiber Optical Cable Delivery:

1. No cable over one year old when delivered to the site will be accepted.



2. Keep ends of cables sealed at all times, except when making splices or terminations. Use methods approved by cable manufacturer.
  3. Include the following data durably marked on each reel:
    - a. Facility name and address.
    - b. Contractor's name.
    - c. Project title and number.
    - d. Date of manufacture.
    - e. Manufacturer's name.
    - f. Linear feet.
- B. Cable Storage: Store where cable will be at temperature recommended by cable manufacturer for optimum workability.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering Products that may be incorporated in the Work include, but are not limited to, the following:
1. Cable:
    - a. Mohawk/CDT.
    - b. Commscope.
    - c. Belden
    - d. Amp
    - e. Cisco
    - f. Or approved equal
  2. Connecting Devices:

- a. Leviton
- b. Krone
- c. Amp
- d. Cornell
- e. Or approved equal

## 2.02 SYSTEM REQUIREMENTS

- A. General: Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.
- B. Expansion Capability: Unless otherwise indicated, quantity of spare conductor pairs in cables, positions in patch panels, cross connects, spare room in equipment racks and terminal strips shall be adequate to accommodate a 10 percent future increase in active workstations.
- C. Installer shall determine the quantities of station runs, distribution (backbone) runs, patch panels and all necessary equipment to install data system.

## 2.03 WIRING PATHWAY AND EQUIPMENT MOUNTING ELEMENTS

- A. Distribution IDF Cabinets: Cabinet: Provide lockable, floor-mounted steel units designed for telecommunications terminal and equipment support and coordinated with dimensions of the units to be supported.
  - 1. Each wiring closet is to have adequate quantities of floor standing equipment racks to house patch panels, fiber housings, wire management, data switching equipment and expansion capability. Minimum requirements (2) cabinets for MDF-1, (1) cabinet for IDF-2 and (1) cabinet for IDF-3.
  - 2. Placement of the racks must adhere to applicable EIA/TIA standards for equipment room layout. If conflicts exist between field conditions and standards requirements, then it is the responsibility of the cabling contractor to bring this situation to the attention of the Owner and the engineer. Final locations shall be determined by Owner.
  - 3. Black, baked-polyester powder coat finish with smoked plexi-glass front with lock and (2) top mounted powered fans.
  - 4. Power strip with 10 surge protected outlets.
  - 5. Approximate Dimensions: 84 inches high by 22 inches wide (2130 mm high by 560 mm wide) overall. (For standard 19" wide rack mounted equipment).

## B. Wire Management

1. Double sided horizontal wire management is to be installed above, between and below each patch panel and fiber housing.
2. Top and bottom position wire managers are to be 1.5 inches
3. Wire managers installed in between patch panels are to be 3.0 inches.
4. Double sided, vertical wire management is to be installed down one side of each equipment rack. If multiple equipment racks will be located together in the same wiring closet, then vertical wire managers should be center-mounting type.
5. For Vertical Wire Managers, Minimum Channel Size For Each Channel (Front And Back) Is To Be 4 X4 Inches.

## 2.04 DATA CABLES, CONNECTORS, AND TERMINAL EQUIPMENT

- A. Listed as Complying with Category 6 of EIA/TIA-568: Provide evidence of listing for all products specified in this Article.
- B. Data cables shall be 24 awg, (4) pair, unshielded twisted pair (utp) Category 6 (400mhz) cable. The cable sheath is to be blue in color for identification purposes, and labeled to reflect its Category 6 (400mhz) rating. Cable is to meet or exceed the Category 6 (400mhz) rating and be plenum rated.
- C. Wireless Access Data cables shall be 24 awg, (4) pair, unshielded twisted pair (utp) Category 6 (400mhz) cable. The cable sheath is to be yellow in color for identification purposes, and labeled to reflect its Category 6 (400mhz) rating. Cable is to meet or exceed the Category 6 (400mhz) rating and be plenum rated.
- D. Security Data cables shall be 24 awg, (4) pair, unshielded twisted pair (utp) Category 6 (400mhz) cable. The cable sheath is to be green in color for identification purposes, and labeled to reflect its Category 6 (400mhz) rating. Cable is to meet or exceed the Category 6 (400mhz) rating and be plenum rated.
- E. Patch Panels
  1. Patch panels are to be 48 port and 96 port, Category 6 utilizing EIA/TIA 568-B terminations.
  2. Panels are to be rack mounted with black anodized faceplates.
  3. Patch panels shall have 110 style connectors for the termination of station wiring.

4. If A Patch Panel Port Is Not Functional, Or Cannot Pass Certification Testing, Then It shall be replaced Or The Entire Patch Panel.

F. Face Plates and inserts

1. Data Station faceplates shall be single gang and provide single, two, four, or six ports, dependant on the number of cables at the drop location. Faceplates are to house modular RJ-45 inserts as required.
2. Data modular inserts shall be Category 6 and be flush mounted in faceplate. Terminating Procedures Must Strictly Adhere To The Eia/Tia 568-B Wiring Code.
3. Faceplates shall have ample room to accommodate labeling as detailed further in this specification. Blanks shall be installed in all unused ports.
4. All faceplates shall be compatible with floor boxes.

- G. Patch Cords: Red Category 6 patch cables in 24 and 36-inch lengths. Provide one for each patch panel port in the following quantities- 50% at 24 inch and 50% at 36 inch.

- H. Station Cables (for connecting computers & printers) : Provide one Blue Category 6 cable for each patch panel port in the following quantities- 25% at 5 foot, 25% at 10 foot, 25% at 15 foot and 25% at 25 foot.

## 2.05 FIBER OPTIC CABLE CONNECTORS AND EQUIPMENT

- A. Fiber Optic Connectors: Connectors shall be "ST" type, with epoxy-less crimp and ceramic ferrule . Connectors must be compatible with fiber optic cable used on the project. DB loss shall not exceed manufacturer's specified maximum loss per connector.

1. Breakout kits shall be used for all "Loosetube" cables.

- B. Fiber Optic Distribution Panels: Panels shall be compatible with a 19" equipment rack and consist of an enclosure fitted with ST style multimode adapter plates for all fiber strands. Each panel shall provide 24 ports.

- C. Fiber Optic Termination Cabinet (FTC)

1. 16 gauge steel enclosure with lock by Corning or equal.
2. Adapter plate with factory mounted ST type multimode feed-thru adapters (number of adapters as required).

D. Fiber Patch Cords:

1. Duplex 50 micron/125 micron (core/clad) multimode optical fibers, with a UL rating of OFNR. Optical performance and manufacturer to be the same as specified for fiber optic cable.
2. PVC outer jacket.
3. Cable length of 1 meter.
4. Connectors: Cables shall utilize dual ST-style to SC-style factory-terminated connectors.
5. Quantity equal to the number of fiber connections in each wiring closet, plus one additional cable per closet.

E. Fiber Optic Labels:

1. One label shall be securely fastened to innerduct or fiber optic cable at all pull boxes, manholes, termination points and splice points.
2. Labels shall be plastic laminate with engraved letters of 1/4 inch minimum. Labels shall contain fiber type, size and destination.
3. Each fiber strand and ST connector shall be labeled with a printed label corresponding to an identical label at opposite end.

2.06 IDENTIFICATION PRODUCTS

- A. Cable Labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.

2.07 INSTALLATION PRODUCTS

- A. Cable Hooks: Steel hooks designed for support of cables; Arlington Industries "CH1M" series, or equal. Provide beam clamps, rods, or other hardware as needed to attach cable hooks to building structure.
- B. Sleeves: Provide at least one steel conduit sleeve (minimum size 1.5"), with plastic bushings on each end of conduit from each/every room where there are data and/or video drops. Sleeve shall run from room into hallway to allow for the routing of cabling to nearest data closet. Sleeve shall be installed above accessible ceilings and be placed to avoid mechanical, electric and plumbing work. Provide additional sleeves as required to accommodate number of cables.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine pathway elements to receive cable. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Wiring Method: Install cables in raceway system in all areas where cable will be exposed. In slab installation, cable is to be installed in PVC. Install pull string in raceways with wiring. Conceal cables except in unfinished spaces and within data closets. In locations with accessible ceilings, cables may be bundled and run above the ceiling supported on cable hooks .
- B. Back boxes: plastic insert boxes or insert rings with pressure mounts are not acceptable attachments. All cables terminated on wall plates should be contained within a metal electrical box
- C. Cable Routing shall be via the shortest route, and shall be as per EIA/TIA 568 Standards. Routing is to be determined by the Cabling Contactor unless otherwise indicated .
- D. Install cable without damaging conductors, shield, or jacket.
- E. Do not bend cable in handling or installation to smaller radii than minimums recommended by manufacturers.
- F. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
  - 1. Pull cables simultaneously where more than one is being installed in the same raceway.
  - 2. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway.
- G. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.
- H. Secure and support cable not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

- I. Wiring within data closets and Enclosures: Provide adequate length of conductors. Train the conductors to terminal points with no excess. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to radii smaller than allowed.
- J. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
- K. Provide conduit sleeves with protective bushing on ends required for routing of cables.

### 3.03 DATA CABLE INSTALLATION

- A. All voice and data cables are to be terminated . Pair twist must be maintained to within .5 inch of termination point.
- B. Install components as indicated, according to manufacturers' written instructions. Use techniques, practices, and methods that are consistent with EIA/TIA 568 standards.
- C. All data outlets shall be cabled with individual 4-pair cable with unbroken return to punch down on back of patch panels in closets.
  - 1. No splicing of cable will be allowed.
- D. All horizontal data cables shall be independently supported of building structure above suspended ceilings, tunnels, etc. The use of "j" hooks or equivalent hangers are required.
  - 1. Cable supports or hangers shall be placed at a minimum of 3 ½ foot intervals, or closer, to prevent sagging. Install hangers so that all cable is run in the same horizontal plane without rises and falls that cause radiuses in the cable.
  - 2. Cables shall be bundled in groups of not greater than 40 cables in order to insure that bottom cables are not deformed.
- E. Separation of Wires: Comply with EIA/TIA-569 rules for separation of unshielded copper data system cables from potential EMI sources, including electrical power lines and equipment.
  - 1. All telecommunications cabling should be separated from a/c power cables by a minimum distance of 12".
- F. Provide 3 feet of cable Slack On The Wiring Closet Side Of The Cables To Allow For Adjustment Of Rack And Patch Panel Positions.

### 3.04 FIBER OPTIC CABLE INSTALLATION

- A. All fiber optic cable must be installed with orange innerduct. Manufacturer's recommendations for maximum pulling tension and bend radius shall be observed. Cable lubricant shall be applied to all pulls through innerduct.
- B. All fiber optic cables must be continuous between distribution frames; no splices will be allowed.
- C. Fiber optic cables passing through pull boxes and manholes shall have a service loop of not less than once the inside perimeter of pull box or manhole. Loops shall be inclusive of innerduct.
- D. A service loop of no less than 20 ft. shall be fastened to building structure, in a secure location, at all termination points.
- E. All Fiber Optic Cable Strands Are To Be Terminated.

### 3.05 GROUNDING

- A. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common mode returns, noise pickup, cross talk, and other impairments.
- B. Bond shields and drain conductors to ground at only one point in each circuit.
- C. Signal Ground Terminal: Locate at each equipment room and wiring closet. Isolate from power system and equipment grounding.
- D. Install grounding electrodes of type, size, location, and quantity as indicated. Comply with installation requirements of Division 26 Section "Grounding."
- E. Signal Ground Bus: Mount on wall of main equipment room with stand-off insulators.
- F. Signal Ground Backbone Cable: Extend from signal ground bus to signal ground terminal in each wiring closet and equipment room.

### 3.06 INSTALLATION AT MDF/ IDF

- A. Mount patch panels, network switches, terminal strips, UPS units, Fiber Termination cabinets and other connecting hardware in racks, except as otherwise indicated.
- B. Group connecting hardware for cables into separate logical fields.
- C. Provide fiber connectivity to owners existing MDF racks and any associated equipment to complete connectivity.



### 3.07 LABELING

- A. Labeling shall conform to ANSI/TIA/EIA-606 standards. In addition, provide the following:
- B. Label each outlet with permanent self-adhesive label with minimum 3/16 in. high characters.
- C. Label each cable with permanent self-adhesive label with minimum, 1/8 in. high characters, in the following locations:
  - 1. Inside receptacle box at the work area.
  - 2. Behind the communication closet patch panel or punch block.
- D. Use labels on face of data patch panels. Provide facility assignment records in a protective cover at each telecommunications closet location that is specific to the facilities terminated therein.
- E. Use color-coded labels for each termination field that conforms to ANSI/TIA/EIA-606 standard color codes for termination blocks.
- F. Labels shall be machine-printed. Hand-lettered labels shall not be acceptable.
- G. Label cables, outlets and patch panels with prefix (D=Data and V=Video) and room number in which outlet is located, followed by a single letter suffix to indicate particular outlet within room, i.e., D107A, D107B, V107. Indicate riser cables by an R then pair or cable number.
- H. Fiber optic labels shall be securely fastened to innerduct and fiber optic cables at all pullboxes, manholes, termination points and splice points.
- I. Fiber optic labels shall be plastic laminate with engraved letters of 1/4 inch minimum. Labels shall contain fiber type, size and destination.
- J. Each fiber strand and ST connector shall be labeled with a printed label corresponding to an identical label at opposite end.
- K. Mark up floor plans showing outlet locations, type, and cable marking of cables. Turn these drawings over to the owner two (2) weeks prior to move in to allow the owner's personnel to connect and test owner-provided equipment in a timely fashion. Obtain floor plans from Architect.
- L. Three (3) sets of as-built drawing shall be delivered to the owner within four (4) weeks of acceptance of project by the owner. A set of as-built drawings shall be provided to the owner in compact disc media form and utilizing CAD software that is acceptable to the owner. The compact disc media shall be delivered to the owner within six (6) weeks of acceptance of project by owner.

### 3.08 TESTING

#### A. Copper (UTP) Testing:

1. Testing of all data cabling shall be performed prior to system cutover. 100 percent of the horizontal and riser wiring pairs shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage. Horizontal data cabling pairs shall be tested from the information outlet to the corresponding IDF point of termination.
2. Data cable runs shall be tested for conformance to the specifications of EIA/TIA 568B Category 6.
3. Test Equipment shall comply with TIA/EIA TSB-67 for level II, TIA/EIATSB-95 for Level IIE, and TIA/EIA 568A Level III Accuracy at basic link.
4. All Data Cables (And All Pairs) Shall Be Tested From Patch Panel to Jack and must measure network-specific channel response to provide accurate pass/fail for all major LAN networking standards.
5. Must be able to provide graphic reports with printouts of full plot data.
6. Complete, end to end test results must be submitted to the owner.

#### B. Optical Fiber Cable Testing:

1. Each fiber strand, including spare strands, shall be Optical Time Domain Reflectometer (OTDR) tested. Detailed testing specifications will be available after the bid award.
2. The OTDR used shall be equipped with suitable launch cables. The OTDR traces will accurately display dB loss per division and magnify to the largest scale possible, zooming in on the trace being monitored. The raw information that is gathered shall be compiled and displayed in a simple and useable manner. Test results shall be stored on a disk. Hard copy, printed results showing bandwidth (design) and dB loss shall be submitted with documentation package.
3. Horizontal Link Measurement
  - a. The horizontal link should be tested at 850 nm or 1300 nm in one direction in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper. The attenuation results should be less than 2.0 dB. This value is based on the loss of two (2) connector pairs, one (1) pair at the telecommunications outlet/connector and one (1) pair at the horizontal cross-connect, plus 90 m (295 ft) of optical fiber cable.
4. Backbone Link Measurement

- a. The backbone optical fiber link segment will be tested in one direction at BOTH operating wavelengths to account for attenuation deltas associated with wavelength. Single-mode backbone links will be tested at 1310 nm and 1550 nm in accordance with ANSI/EIA/TIA-526-7, Method A.1, One Reference Jumper. 50/125 um backbone links will be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA -526-14A, Method A.1, One Reference Jumper.
  5. Cables must pass all tests, for all stands, or shall be repaired or replaced.
- C. Pre-installation Cable Testing:
1. The Contractor shall test all lightguide cable prior to the installation of the cable.
  2. The Contractor shall assume all liability for the replacement of the cable should it be found defective at a later date.

### 3.09 FIELD QUALITY CONTROL

- A. Employ job superintendent, certified manufacturer of network switches and project manager during the course of the installation to provide coordination of work of this specification and of other related specifications, and provide technical information when requested by owner.

### 3.010 DOCUMENTATION

- A. Submit project record drawings at conclusion of the project and include:
  1. Approved shop drawings.
  2. Plan drawings indicating locations and identification of work area outlets, nodes, IDF and backbone (riser) cable runs.
  3. Cross-connect schedules including entrance point, main cross-connects, intermediate cross-connects, and horizontal cross-connects.
  4. Labeling and administration documentation.
  5. Warranty documents for equipment.
  6. Copper certification test result printouts and loaded onto a USB thumb drive.
  7. Optical fiber power meter/light source test results.

8. Operation and maintenance manuals

3.011 CLEANING

- A. On completion of system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

3.012 TRAINING

- A. The contractor shall provide one (1) man for one (1) week (40 hours) at school beginning with the first scheduled move-in date. This technician will also assist the owner in cross connecting the security, VoIP Telephone, IP CCTV and data services throughout the buildings during the move-in period. It is at this time that all owners provided connectivity schedules for voice and data services will be provided to the contractor. Patching (cross connection) of the station assignments between the owners service demarc shall also be considered part of this contractors work.

END OF SECTION 272102

## SECTION 276600 – COMMUNICATIONS EQUIPMENT ROOMS AND FITTINGS

### PART 1 – GENERAL

#### 1.1 WORK INCLUDED

- A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents.
- B. Telecommunications Rooms (MDF/IDF) are generally considered to be floor serving facilities. Horizontal Cross-connects link the Horizontal cable and the Backbone Cable together. The Horizontal Cross-connects shall consist of rack or wall mounted wiring blocks or panels for termination of copper cables or rack or wall mount interconnect termination units or fiber management panels/trays for the termination of optical fibers. Cross-connect spaces include the labeling of hardware for providing circuit identification and patch cords or cross-connect wire used for creating circuit connections at the cross-connect.

#### 1.2 SCOPE

- A. This section includes the minimum requirements for equipment, termination hardware and cable installations in communication equipment rooms.
- B. The telecommunications room shall be equipped to contain telecommunications equipment, cable terminations, and associated cross-connects.
- C. Minimum composition requirements and installation methods for the following:
  - 1. Floor Mounted Relay Racks
  - 2. Wall Mounted Relay Racks and Brackets
  - 3. Floor Mounted Cabinets
  - 4. Cable Management Hardware
  - 5. Cable Ladder Rack (Provided by Electrical Contractor)
  - 6. Patch Panels - Category 6 - Voice
  - 7. Patch Panels - Category 6 - Data
  - 8. Fiber optic panels - Wall Mount Box
  - 9. Fiber optic panels - rack mount (low fiber count)
  - 10. Fiber optic panels/frames- rack mount (moderate fiber count)
  - 11. Fiber optic frames - rack mount (high fiber count)
  - 12. Fiber optic trays - rack mount
  - 13. Back Boards
  - 14. 66 System Blocks
  - 15. Cross Connect Wire
  - 16. Power Strips
  - 17. Optical Fiber Patch Cords
  - 18. Patch Cords - UTP Category 6 - Voice
  - 19. Patch Cords - UTP Category 6 - Data
  - 20. 66 System Patch Cords - Category 6 – Voice
  - 22. Uninterruptable Power Supplies (UPS)

#### 1.3 QUALITY ASSURANCE

- A. All equipment rooms shall be installed in a neat and workmanlike manner.

- B. All methods of construction that are not specifically described or indicated in the Contract Documents shall be subject to the control and approval of the Authority's representative.
- C. Equipment and materials shall be of the quality and Manufacturer indicated.
- D. The equipment specified is based on the acceptable manufacturers listed.
- E. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified, and subject to approval.
- F. Separation from sources of EMI shall be as specified in section.
- G. Communication grounding/earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC 1000-5-2, ANSI/TIA/EIA-607, or both be observed throughout the entire cabling system.
- H. Materials and work specified herein shall comply with the applicable requirements of:
  - 1. EIA/TIA-568-A.
  - 2. EIA/TIA-569-A
  - 3. EIA/TIA-606
  - 4. EIA/TIA-607
  - 5. Underwriters Laboratory
  - 6. Federal Communications Commission (including CFR 47 and Part 68 - subpart F)
  - 7. National Electric Code
  - 8. Local and State Codes
  - 9. ISO/IEC 11801
  - 10. IEC 1000-5-2
  - 11. CSA C22.2
  - 12. IEC 60603-7
- I. Manufacturers shall be ISO 9001 Certified, for all components that are required to have submittals provided as part of this section.

## PART 2 – PRODUCTS

### 2.1 FLOOR MOUNTED RELAY RACKS

- A. Racks shall meet the following physical specifications:
  - 1. 19" rack mounting space.
  - 2. 7 foot high.
  - 3. Lightweight, high strength aluminum construction.
  - 4. Black powder coat finish.
  - 5. 15" deep base with four (4) ¾" bolt down holes.
  - 6. EIA Channel width of 3.0", with #12-24 screw holes
- B. Rack shall have double sided 12/24 tapped holes and EIA universal rack 5/8" to 5/8"- 1/2" standard hole pattern (compatible with 1 1/4" – 1/2" hole patterns)

## 2.2 WALL MOUNTED RELAY RACKS

- A. Wall Mounted Relay Racks shall be provided in locations designated on the drawings and shall meet the following physical specifications:
  - 1. 19" EIA rack mounting space.
  - 2. 48" high with 24 mounting spaces.
  - 3. Lightweight, high strength steel construction.
  - 4. Black powder coat finish.
  - 5. Stationary mounting with 21" deep, 14 gauge mounting brackets and 100 lb. capacity.
  - 6. Racks shall have double sides EIA universal rack 5/8" to 5/8" - 1/2" standard hole pattern (compatible with 1 1/4" - 1/2" hole patterns)

## 2.3 FLOOR MOUNTED CABINET

- A. Floor mounted cabinets shall meet the following specifications:
  - 1. 16 gauge steel construction
  - 2. Nominal 77"x21"x36"
  - 3. Vented roof
  - 4. Removable side panels.
  - 5. Leveling feet

## 2.4 CABLE MANAGEMENT FOR RELAY RACKS

- A. Cable management shall be black metal with integral wire retaining fingers.
- B. Vertical cable management panels shall have front and rear channels.
- C. Vertical cable management panels shall have removable front and back covers, made of black metal.
- D. A horizontal crossover cable manager shall be provided at the top of each relay rack, with a minimum height of 2 rack units each.
- E. A horizontal crossover cable manager shall be provided near the center and at the bottom of each relay rack, with a minimum height of 4 rack units.

## 2.5 LADDER RACK

- A. Provide ladder rack in Telecommunications Room (MDF/IDF) as shown on drawings for horizontal cable support).

## 2.6 PATCH PANELS - CATEGORY 6 – VOICE

- A. The termination panels shall support the appropriate Category 6 applications and facilitate cross-connection and inter-connection using modular patch cords.
- B. Shall be sized to fit an EIA standard, 19-inch relay rack, or be capable of mounting to a wall.
- C. Accommodate at least 24 ports for each rack mount space (1rms = 44.5 mm [1.75 in.]).
- D. Have circuit boards tested in both directions as required by ANSI/TIA/EIA-568-A and ISO/IEC 11801.

- E. Have patented angle left/angle right modules to provide optimum cable management.
- F. Have removable six port modules to allow replacement in the field.
- G. Have Category 6 jacks available in both T568A and T568B wiring schemes, with 66-style termination.
- H. Allow for a minimum of 200 re-terminations without signal degradation below standards compliance limit.
- I. Have modular ports compliant with FCC CFR 47 part 68 subpart F and IEC 60603-7 with 50 micro inches of gold plating over nickel contacts or equivalent.
- J. Allow the use of a 4 or 5-pair 66-style impact termination tool.
- K. Be fully enclosed front and provide rear plastic strips for physical for physical protection of printed circuit board.
- L. Have port identification numbers on both the front and rear of the panel.
- M. Provide clear label holders and white designation labels with the panel, with optional color labels available.
- N. Be made by an ISO 9001 Certified Manufacturer.
- O. ANSI/TIA/EIA-568-A and ISO/IEC 11801 proposed Category 6 compliant.
- P. The following requirements shall also be met (NEXT Loss and FEXT tested in both Differential and Common Mode):

Parameters	Performance @ 100 MHz
NEXT Loss	43.0 dB
FEXT	35.1 dB
Insertion Loss (Attenuation)	.4 dB
Return Loss	20 dB

- Q. Be UL VERIFIED for TIA/EIA Category 6 electrical performance.
- R. Shall be UL Verified for Category 6 compliance and be CSA C22.2 approved.
- S. Be made of a steel frame with black power coat finish 24, 48, and 96 port configurations.
- T. Have mounting slots compatible with ANSI/EIA-310.
- U. Allows the modular insert to accept 66-style patch plugs as a means of termination.
- V. Shall be T-568A Wired.
- W. Provide 48 port panels, unless otherwise noted.
- X. Density must accommodate at least 24 port per single rack unit (1.75" or 44.5mm)
- Y. Paired punch down sequence to allow pair twist within ½" of the termination.



- Z. Shall have port identification numbers on front and rear of the panel.
- AA. Support applications up to 250 MHz
- BB. Have 66 style insulation displacement contacts and termination accomplished with a single conductor impact tool or 4 or 5 pair impact tool.
- CC. Be backwards compatible to allow lower performing categories of cables or connecting hardware to operate to their full capacity.
- DD. Have circuit identification and color-coding designation strips provided with the panel.
- EE. Provide port configurations and densities as called for on drawings.
- FF. Provide rear cable management bar(s) as recommended by the manufacturer.
- GG. Shall be Insulation Displacement Connector 66 style terminations
- HH. Provide EIA/TIA 606 compliant color-coded icons or color-coded designation label strips for all patch panels. Identify voice or data functionality as required
- II. Paired punch down sequence to allow pair twist within ½" of the termination.
- JJ. Provide rear stress relief components as recommended by the manufacturer.
- KK. Acceptable Manufacturers
  - 1. Siemon
  - 2. Hubbell
  - 3. Panduit
  - 4. Or approved equal

## 2.7 PATCH PANELS - CATEGORY 6 – DATA

- A. The termination panels shall support the appropriate Category 6 applications and facilitate cross-connection and inter-connection using modular patch cords.
- B. Shall be sized to fit an EIA standard, 19-inch relay rack, or be capable of mounting to a wall.
- C. Be made of a steel frame with black power coat finish, in 24, 48, 72 and 96-port configurations.
- D. Accommodate at least 24 ports for each rack mount space (1rms = 44.5 mm [1.75 in.]).
- E. Have circuit boards tested in both directions as required by ANSI/TIA/EIA-568-A and ISO/IEC 11801.
- F. Have patented angle left/angle right modules to provide optimum cable management.
- G. Have removable six port modules to allow replacement in the field.
- H. Support applications up to 250 MHz
- I. Have Category 6 jacks available in both T568A and T568B wiring schemes, with 66-style termination.
- J. Have 66 style insulation displacement contacts and termination accomplished with a single

conductor impact tool or 4 or 5 pair impact tool.

- K. Be backwards compatible to allow lower performing categories of cables or connecting hardware to operate to their full capacity.
- L. Allow for a minimum of 200 re-terminations without signal degradation below standards compliance limit.
- M. Have modular ports compliant with FCC CFR 47 part 68 subpart F and IEC 60603-7 with 50 microinches of gold plating over nickel contacts or equivalent.
- N. Allow the use of a 4 or 5-pair 66-style impact termination tool.
- O. Be fully enclosed front and provide rear plastic strips for physical protection of printed circuit board.
- P. Have port identification numbers on both the front and rear of the panel.
- Q. Provide clear label holders and white designation labels with the panel, with optional color labels available.
- R. Have circuit identification and color-coding designation strips provided with the panel.
- S. Be made by an ISO 9001 Certified Manufacturer.
- T. ANSI/TIA/EIA-568-A and ISO/IEC 11801 proposed Category 6 channel compliant.
- U. The following requirements shall also be met (NEXT Loss and FEXT tested in both Differential and Common Mode):

Parameters	Performance @ 100 MHz
NEXT Loss	43.0 dB
FEXT	35.1 dB
Insertion Loss (Attenuation)	.4 dB
Return Loss	20 dB

- V. Be UL VERIFIED for TIA/EIA Category 6 electrical performance.
  - 1. Shall be UL Verified for Category 6 compliance and be CSA C22.2 approved.
  - 2. Provide EIA/TIA 606 compliant color-coded icons or color-coded designation label strips for all patch panels. Identify voice or data functionality as required.
  - 3. Provide 48 port panels, unless otherwise noted
- Z. Paired punch down sequence to allow pair twist within ½" of the termination.
- AA. Shall have port identification numbers on front and rear of the panel.
- BB. Density must accommodate at least 24 port per single rack unit (1.75" or 44.5mm)
- CC. Have mounting slots compatible with ANSI/EIA-310.
- DD. Allows the modular insert to accept 66-style patch plugs as a means of termination.
- EE. Shall be T-568A Wired.
- FF. Provide port configurations and densities as called for on drawings.

GG. Provide rear cable management bar(s) as recommended by the manufacturer.

HH. Shall be Insulation Displacement Connector 66 style terminations.

II. Provide rear stress relief components as recommended by the manufacturer.

JJ. Be UL verified for TIA/EIA Category 6 electrical performance.

KK. Acceptable Manufacturers:

1. Siemon
2. Hubbell
3. Panduit
4. Or approved equal

## 2.8 FIBER OPTIC PANELS - WALL MOUNT BOX

A. All panels and trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.

B. The wall mount interconnect center shall:

1. Be available in 12,24 port termination densities for single door applications
2. Be available in 12,24 and 48 port termination densities for dual door applications
3. Accommodate various simplex connectors including ST®, SC, FC and LX.5
4. Have single or dual hinged doors.
5. Have the ability to mount the cable clamp on the interior of the panel
6. Feature adapters which are angled
7. Have radiused outer edges and be putty white in color
8. Offer factory termination of the optical cable as an option
9. Be made by an ISO 9001 certified manufacturer
10. Provide port configurations and densities as called for on drawings.

## 2.10 FIBER OPTIC PANELS - RACK mount (low fiber count)

A. All panels and trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.

B. Shall be available in 12 and 24 port with no splicing.

C. Be available in 24 port configuration for splicing.

D. Allow mounting in either 19" or 23" equipment bays.

E. Allow flush or 5" recess mounting.

F. Use adapter plates that house 6 adapters each.

G. Have adapters angled to the left and right of the panel.

H. Be available in black.

I. Be made by an ISO 9001 certified manufacturer.

- J. Shall meet or exceed all TSB-72 requirements.
- K. Provide port configurations and densities as called for on drawings.
- L. Shall be wall or rack mountable.
- M. Shall have a hinged removable front cover.
- N. Shall feature a front access design with a hinged bulkhead plate.
- O. Shall house 6 adapters per adapter plate.

#### 2.11 FIBER OPTIC PANELS/FRAMES - RACK MOUNT (MODERATE FIBER COUNT)

- A. All panels and trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.
- B. Shall be available in 12, 24, 48, 72 and 96 port configurations.
- C. Feature a front access design with hinged bulkhead plate.
- D. Use adapter plates that house 6 adapters each.
- E. Have a hinged removable front cover.
- F. Have adapters that are angled to the left of the panel.
- G. Have an integrated vertical cableway on one side of the panel.
- H. Be mountable in flush, 1"2" and 5" recess options.
- I. Be 19" and 23" rack mountable.
- J. Have storage and splicing options as part of the product offering.
- K. Support the addition of optical components such as WDM's and splitters to the product offering.
- L. Be available in putty.
- M. Be made by an ISO 9001 certified manufacturer.
- N. Provide port configurations and densities as called for on drawings.

#### 2.12 FIBER OPTIC FRAMES - RACK MOUNT (HIGH FIBER COUNT)

- A. All panels and trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.
- B. Shall be available in putty, and made of 12-gauge aluminum alloy.
- C. Available in up to 24, 32, 48, and 72 port versions with ST® fiber adapters preloaded into adapter plates or 48, 64, 96 and 144 port versions using quad SC fiber adapters preloaded into adapter plates.
- D. Have preloaded adapter plates with SC, ST®, or LX.5 fiber adapters in 6 and 8 port versions as well as a 12 port version for the SC adapter.

- E. Have blank adapter plates for future growth of the fiber infrastructure.
- F. Have fiber managers to effectively store fiber cable slack and comply with fiber bend radius requirements.
- G. Have six and eight port fiber adapter plates, which allow for color coding connectors.
- H. Have fiber adapter plates with snap-in installation.
- I. Accommodate stackable splice trays, each tray manages a total of 24 splices.
- J. Have an adapter plate-mounting bracket, which slides out to the front and to the rear of the unit for increased access.
- K. Have cable access points for fiber jumpers entering and exiting the unit with rotating grommets to facilitate cable loading and to minimize micro bending stress.
- L. Have anchor points for fiber cable(s) entering the unit.
- M. Have labeling which meets or exceeds ANSI/TIA/EIA-606 requirements and also be laser printable.
- N. Be able to mount both 19-inch and 23-inch rack/cabinets.
- O. Be UL C22.2 approved.
- P. Be made by an ISO 9001 Certified Manufacturer.
- Q. Provide port configurations and densities as called for on drawings.

#### 2.13 FIBER OPTIC FRAMES - (HIGH FIBER COUNT)

- A. All panels and trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.
- B. Shall be available in 72 and 96 port configurations.
- C. Feature termination panels with individual adapter retainers.
- D. Feature termination panels with angled adapter retainers with ½ the panel angled to the left and ½ the panel to the right.
- E. Have various termination, splice and storage units available that can be mixed and matched within a common frame.
- F. Support termination densities up to 864 per frame.
- G. Offer connector styles of SC, FC, ST® and LX.5.
- H. Be made by an ISO 9001 certified manufacturer.
- I. Provide port configurations and densities as called for on drawings.

#### 2.14 FIBER OPTIC TRAYS - RACK MOUNT

- A. All panels and trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.

B. Rack-Mounted Fiber Tray

C. The rack mounted fiber tray shall:

1. Be made of 18-gauge steel with a black finish.
2. Available in 16-, 24-, 28-, 32- and 48-port configurations, and be able to double that port count utilizing 6-port adapters.
3. Accommodate SC, ST®, and LX.5 adapters.
4. Accommodate hybrid adapter bezels for ST®-to-SC or SC-to-ST® connections.
5. Have changeable ports, which are removed from the front of the unit to allow custom configuration or modification.
6. Have silk-screened port identification numbers provided on both the front and rear of the panel.
7. Include fiber managers that manage slack storage so as to comply with fiber bend radius requirements and slack storage length recommendations.
8. Accommodate stackable splice trays, which manage up to 24 splices per tray.
9. Have a smoked polycarbonate cover with quarter turn screws for easy access.
10. Not exceed a 254 mm (10 in) depth for mounting in standard cabinets and enclosures.
11. Be provided with strain relief lugs for the fiber cable entering the unit from the side or back.
12. Be made by an ISO 9001 Certified Manufacturer.
13. Provide port configurations and densities as called for on drawings.

2.15 BACKBOARDS

- A. Shall be 4 x 8 x ¾" ACX or BCX, exterior grade, fire rated plywood.
- B. Shall be painted – gray, acrylic, interior, fire retardant paint.
- C. Provide adequate support and dress horizontal cabling between ladder rack and 66 wiring blocks as necessary or as shown on the drawings. Review cable routing plan for the Telecommunications Rooms, in the field, before installation of cabling commences.

2.16 MODULAR 66M SYSTEM BLOCKS

- A. The connecting hardware block shall support the appropriate Category 6, applications and facilitate cross-connection and/or inter-connection using either approved cross-connect wire or patch cords.
- B. Shall be modular 66M System IDC style blocks.
- C. Be UL VERIFIED or equivalent for TIA/EIA proposed Category electrical performance.
- D. Be ANSI/TIA/EIA-568-A and ISO/IEC 11801 Category 6 compliant.
- E. The following requirements shall also be met (NEXT Loss and FEXT tested in both Differential and Common Mode):

Parameters	Performance @ 100 MHz
NEXT Loss	43.0 dB
FEXT	35.1 dB
Insertion Loss (Attenuation)	.4 dB
Return Loss	20 dB

- F. Be UL VERIFIED or equivalent for TIA/EIA proposed Category electrical performance.
- G. Be CSA C22.2 approved or equivalent.
- H. Be made of flame-retardant thermoplastic.
- I. Be available in 50-, 100-, and 300-pair sizes.
- J. Have 50-, 100, - and 300 pair blocks available without legs while the 100, and 300 pair blocks are available without legs.
- K. Blocks shall include means to identify cables/services per ANSI/TIA/EIA-606.
- L. Have clear label holders with the appropriate colored inserts available for the wiring blocks. The insert labels provided with the product shall contain vertical lines spaced on the basis of circuit size (3-, 4- or 5-pair) and shall not interfere with running, tracing or removing jumper wire/patch cords. Label holders must be capable of mounting in the under portion of the wiring block.
- M. Have connecting blocks used for either the termination of cross-connect (jumper) wire or patch cords. The connecting blocks shall be available in 3-, 4- and 5-pair sizes. All connecting blocks shall have color-coded tip and ring designation markers and be of single piece construction.
- N. Have connecting blocks with a minimum of 200 re-terminations without signal degradation below standards compliance limit.
- O. Support wire sizes: Solid 22-26 AWG (0.64 mm - 0.40 mm), and 7-strand wires.
- P. Be made by an ISO 9001 Certified Manufacturer.
- Q. Shall be 300 pair blocks, typical for feed and station cable, unless otherwise noted.
- R. Provide keep-off indicator buttons on all active cross-connected pairs used for alarm and security purposes. Coordinate the color and use with the Authority's representative.
- S. Provide connecting block designation label strips of the colors conforming to EIA/TIA 606, including but not limited to the following:

## 2.17 CROSS CONNECT

- A. Provide modular 66M cross connect blocks for all backbone terminations.
- B. Cross-connects shall be made with wire of equal gauge to that of the feed cable, which it is being connected to.
- C. Shall be UL listed
- D. Provide (1) roll of 1 pair and (1) roll of 2 pair per Telecommunications Room (TR). Coordinate color code of one and two pair with the Authority's representative.

## 2.18 POWER STRIP

- A. Shall be 20 amp, 115V.
- B. Shall be rack mounted.
- C. Shall be non-switched.

- D. Shall provide a minimum of one power strip per rack that contains active electronics, or as detailed on the drawings.
- E. Shall be surge suppressed.
- F. Shall have a minimum of 6 outlets – transformer spaced where possible.
- G. Must have 20 amp twist lock plug.
- H. Shall have a 10' cord, minimum.
- I. Shall be UL listed and must meet UL 1363 and 1449 requirements.

#### 2.19 OPTICAL FIBER PATCH CORDS - Multimode

- A. Shall be available in standard lengths of 1, 3, and 5 meters, custom lengths shall also be available, and shall meet or exceed standards as defined in ANSI/TIA/EIA-568-A and ISO/IEC 11801.
- B. Utilize duplex optical fiber cable that is 62.5/125 or 50/125 micron multimode, OFNR riser grade, and meets the requirements of UL 1666.
- C. Utilize optical fiber cable where the attenuation shall not exceed 3.5 dB/km @ 850 nm wavelength or 1.0 dB/km @ 1300 nm.
- D. Have a cable jacket color for 62.5/125 in gray and 50/125 in orange.
- E. Be equipped with SC or ST® in accordance with TIA/EIA-568-A and must include a ceramic ferrule.
- F. Have ST® connectors with a metal coupling nut.
- G. Have terminated connectors exhibit a maximum insertion loss of 0.75 dB with an average of 0.40dB when tested at either 850 nm or 1300 nm wavelengths for 62.5/125 □m.
- H. Have terminated connectors exhibit a maximum insertion loss of 0.75 dB with an average of 0.50dB when tested at either 850 nm or 1300 nm wavelengths for 50/125 □m.
- I. Have a minimum return loss of 20 dB (25 dB typical) at both 850 nm & 1300 nm.
- J. Be made by an ISO 9001 Certified Manufacturer.
- K. Be UL 1666 approved.
- L. Shall be a duplex fiber cable meeting or exceeding the transmission characteristics of the optical fiber horizontal cable.
- M. Connectors shall be either LX.5 or duplex T568SC, as specified on the drawings or equipment schedules.
- N. Jackets shall be orange in color for multi-mode connections and yellow for single mode connections.
- O. The following configurations may be required:



1. ST/ST
2. SC/SC
3. LX.5/LX.5
4. ST/SC
5. SC/LX.5
6. ST/LX.5

## 2.20 CATEGORY 6 PATCH CORDS - MATCH COLOR OF VOICE CABLES

- A. Shall be round, and consist of eight insulated 24 AWG, stranded copper conductors, arranged in four color-coded twisted-pairs within a flame-retardant jacket.
- B. Be equipped with modular 8-position plugs on both ends, wired straight through with standards compliant wiring.
- C. Use modular plugs, which exceed FCC CFR 47 part 68 subpart F and IEC 60603-7 specifications, and have 50 microinches minimum of gold plating over nickel contacts.
- D. Be resistant to corrosion from humidity, extreme temperatures, and airborne contaminants.
- E. Utilize cable that exhibits power sum NEXT performance.
- F. Be available in several colors with or without color strain relief boots providing snagless design.
- G. Meet the flex test requirements of 1000 cycles with boots and 100 cycles without boots.
- H. Be available in any custom length and standard lengths of meters (3, 5, 7, 10, 15, 20, and 25 feet).
- I. Be made by an ISO 9001 Certified Manufacturer.
- J. Electrical Specifications:
  1. Input impedance without averaging 100 + 15% from 1 to 100 MHz.
  2. 100% transmission tested for performance up to 100 MHz. Manufacturer shall guarantee cords are compatible with Category 6 links.
  3. Utilize cable that is UL VERIFIED (or equivalent) for TIA/EIA proposed Category 6 electrical performance.
  4. UL LISTED 1863.

## 2.21 CATEGORY 6 PATCH CORDS - MATCH COLOR OF DATA CABLE

- A. Shall be round, and consist of eight insulated 24 AWG, stranded copper conductors, arranged in four color-coded twisted-pairs within a flame-retardant jacket.
- B. Be equipped with modular 8-position plugs on both ends, wired straight through with standards compliant wiring.
- C. Be backwards compatible with lower performing categories.
- D. Use modular plugs, which exceed FCC CFR 47 part 68 subpart F and IEC 60603-7 specifications, and have 50 microinches minimum of gold plating over nickel contacts.
- E. Have matching color strain relief boot with a snagless design which shall meet the flex testing as called out in 1000 cycles with boots and 100 cycles without boots.

- F. Be resistant to corrosion from humidity, extreme temperatures, and airborne contaminants.
- G. Utilize cable that exhibits power sum NEXT performance.
- H. Be available in any custom length and standard lengths of (3, 5, 7, 10, 15, 20, and 25 feet).
- I. Be made by an ISO 9001 Certified Manufacturer.
- J. Electrical Specifications:
  - 1. Have input impedance without averaging: 100 + 15% from 1 to 100 MHz, + 22% from 100 to 200 MHz and + 32% from 200 to 250 MHz.
  - 2. Be 100% transmission tested for performance up to 250 MHz. Manufacturer shall guarantee cords are compatible with proposed Cat-6 links.
  - 3. Utilize cable that is UL VERIFIED (or equivalent) for TIA/EIA proposed Category 6 electrical performance.
  - 4. Be UL LISTED 1863.

## 2.23 UNINTERUPPTABLE POWER SUPPLY (UPS)

- A. Input and Output connections of the UPS units shall be configured in accordance with the devices the unit is intended to power.
- B. Individual UPS units shall be sized to provided two (2) hours of operation for the equipment it powers.
- C. UPS units shall comply with the following specification:
  - 1. Waveform Type shall be sine wave.
  - 2. Battery Type Sealed Lead-Acid battery
  - 3. Interface Port: DB9, RS232
  - 4. Mgmt. Software Windows based with Server Shut down
  - 5. Rack Mounted.
  - 6. Acceptable Manufacturers:
    - a. APC
    - b. Tripp Lite
    - c. Best Power
    - e. Or approved equal

## PART 3 - EXECUTION

### 3.1 FLOOR MOUNTED RELAY RACKS

- A. All racks shall be anchored to the floor.
- B. Provide vertical and horizontal cable as shown on drawing.
- C. Mount with a minimum of 36" feet clear access behind and front of rack from the wall to a rack.
- D. Ground the rack to the equipment ground bar with a #6 copper wire.
- E. Communication grounding/earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC 1000-5-2, ANSI/TIA/EIA-607, or both be observed throughout the entire cabling system.

### 3.2 WALL MOUNTED RELAY RACKS

- A. Secure Wall Mounted Relay Racks to building structure with approved anchoring means.
- B. Verify all existing wall construction and submit proposed anchoring methods for approval.
- C. Provide vertical and horizontal cable management both front and rear wherever available.

### 3.3 LADDER RACK

- A. Ladder Rack shall be secured to walls and top of equipment rack.
- B. Communication grounding/earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC 1000-5-2, ANSI/TIA/EIA-607, or both be observed throughout the entire cabling system.

### 3.4 CABLE MANAGEMENT

- A. Provide horizontal and vertical cable management in each cabinet; with horizontal cable management between each piece of electronics.
- B. A horizontal crossover cable manager shall be provided at the top and bottom of each relay rack, with a minimum height of 2 rack units each.
- C. A horizontal crossover cable manager shall be provided near the center of each relay rack, with a minimum height of 4 rack units.
- D. Provide two rear cable management bars and reusable Velcro-type hook and loop straps in each rear vertical channel. Reusable straps shall be of varying sizes (each allowing 50% spare future expansion) and of adequate quantity to secure cable bundles at least every 4 rack units.
- E. Secure cable managers, slack managers, support bars, hook and loop straps per manufacturer recommendations.

### 3.5 CATEGORY 6 PATCH PANELS – VOICE

- A. Install and label as recommended by manufacturer per all EIA/TIA 606.
- B. Install rear cable management bar(s) as recommended by manufacturer.
- C. Install EIA/TIA 606 compliant color-coded icons or color-coded designation label strips for all patch panels. Identify voice functionality.

### 3.6 CATEGORY 6 PATCH PANELS – DATA

- A. Install and label as recommended by manufacturer, per all EIA/TIA 606.
- B. Install rear cable management bar(s) as recommended by manufacturer.
- C. Install EIA/TIA 606 compliant color-coded icons or color-coded designation label strips for all patch panels. Identify Data functionality.

### 3.7 OPTICAL FIBER PATCH PANELS

- A. Install as shown on drawings.

- B. Furnish and Install labels for each strand, as per the Authority's instruction in the field or as shown on drawings.
- C. Install blank adapter panels in all positions not used at time of installation for fiber terminations.

### 3.8 CABLE SUPPORTS

- A. Provide "D" rings on 2 ft. center for all exposed wall mounted vertical Category 6 cable runs.
- B. Keep horizontal wall mounted cable runs to a minimum. In general, horizontal runs shall be on wall mounted ladder rack.
- C. Provide cable brackets 3' on center supported to building structure for all cable runs not supported by cable tray.

### 3.9 BACKBOARDS

- A. Linear wall space used for anchoring equipment shall be lined for the full room width with plywood, per the drawings.
- B. Plywood for mounting termination equipment on shall be installed vertically, side by each, a minimum of 6" above finished floor. Mounting shall be sufficient enough to support the equipment.
- C. Plywood for supporting backbone riser cables shall be installed vertically, resting directly on the finished floor. Anchoring and mounting techniques of plywood used to support backbone riser cables shall be sufficient to support a minimum of 1000 pounds of weight.
- D. In no cases shall the heads of mounting screws protrude past the face of any plywood.
- E. Install distribution rings for the cross-connect fields above all wall mounted blocks. Two rings per vertical row of blocks. Mount rings with two hex head screws per ring.

### 3.10 MISCELLANEOUS REQUIREMENTS

- A. All cables shall be neatly "dressed out" in equipment rooms.
- B. Provide service loops on all cables terminated in the telecommunications rooms, per the drawings.
- C. Firestop all sleeves and conduits openings after the cable installation is complete.

### 3.11 MODULAT 66M SYSTEM BLOCKS

- A. Installed on plywood backboard so that top of 300 pair block is 5'6" AFF, or as noted on the drawing.
- B. Mount Blocks with steel, zinc plated 5/16" slotted hex head #10 x 3/4" drill screws, minimum four screws per block.
- C. Install designation strips color-coded in conformance with EIA/TIA 606 standard.
- D. Install insulator clips (sometimes called keep-offs) on all Life and Safety special circuits in the Telecommunications Rooms (MDF/IDF), coordinate desired color code requirements with the Authority's representative.

END OF SECTION 276600

## SECTION 311000 – SITE CLEARING

### 1.0 SCOPE OF WORK

- 1.1 Under this section of the Specifications, the Contractor shall provide all labor, tools, materials, and equipment required to perform all site clearing work including, but not limited to: topsoil stripping, structure, fencing, wall, fixture, appliance and equipment removals, asphalt removal, concrete removal, curbing removal, utility disconnections and removal, roadway and street removal, decorations removals, stone removal, masonry removals, timber and lumber removals, clearing, grubbing, tree stump and root removals, any and all man-made improvement removals, and in accordance with the Drawings and Specifications.

### 2.0 GENERAL REQUIREMENTS

- 2.1 The Contractor shall visit the site, prior to submitting his bid, inform himself of the conditions, and make his own estimates of the facilities and difficulties attending the execution of the work.
- 2.2 The Contractor shall be responsible for avoidance and cleanup of street spillage and tracking to the satisfaction of the local and state authorities, and the Owner.
- 2.3 The Contractor shall be responsible for dust control on and near the site and at all off-site waste areas if such dust is caused by the Contractor's operations or if resulting from the condition in which the Contractor leaves the site.
- 2.4 The Contractor shall be responsible for any and all dewatering as may be required to satisfactorily perform all work detailed on the drawings or specified herein.
- 2.5 The right to make any inspections deemed necessary at the source of supply, and during preparation of any material used in this work, is reserved by the Owner.

### 3.0 RELATED WORK SPECIFIED ELSEWHERE

- 3.1 Earthwork – See Section 312001.
- 3.2 Soil Conservation – See Section 313117.

### 4.0 REGULATORY REQUIREMENTS

- 4.1 All clearing, grubbing, and stripping shall comply with all local, state, and federal regulations regarding erosion and sedimentation control.
- 4.2 Coordinate clearing work with utility companies.

### 5.0 MATERIALS

Not Applicable

## 6.0 EXECUTION

### 6.1 Clearing Site

- A. Before demolition or soil remediation construction is begun in any area, the site of the Project shall be cleared within the limits of construction. The ground surface shall be cleared of all trees, brush, weeds, roots, matted leaves, small structures, debris, and other objectionable material, vegetation, and growth. Soil erosion and sediment control shall be in accordance with Section 313117.
- B. All tree stumps shall be grubbed out within the limits of the project.
- C. Trees, shrubs, and other landscape features within the limits of construction which do not interfere with the Project and are designated for preservation shall not be removed but shall be protected during the progress of the work.
- D. Every necessary precaution shall be taken to prevent damage or injury to existing trees, plants, and other vegetation that are to remain within or adjacent to the Project.
- E. At locations adjacent to operations performed by motorized equipment, a 4 foot high snow fence shall be erected and maintained around all trees, shrubs, and areas containing vegetation which are to be preserved.

### 6.2 Stripping of Topsoil

- A. Excavate topsoil and organic surficial soils to a depth not to exceed 6 inches within the limits of work without mixing with foreign materials. If suitable, existing topsoil can be used for final grading.
- B. Topsoil required in the final work shall be stockpiled on the site as directed by the Owner.
- C. Stockpiles shall be constructed in such a manner that they will be well drained and will not impound water or impede the natural drainage.
- D. All other topsoil and organic surficial soils shall be removed from the site.

### 6.3 Removal of Pipe, Inlets, and Manholes

- A. Excavation for the removal of existing pipe, inlets, and manholes shall be in accordance with the following:
  - a) Before excavating, existing subsurface structures shall be located which may be affected by or interfere with the proposed construction. If directed, test pits shall be excavated to obtain the required information. Test pits or portions of a test pit shall be dug by hand when in close proximity to utilities or when directed. Test pits shall be backfilled in accordance with Subsection D-3.068.
  - b) The excavation shall be made in open cut and shall be of sufficient size to permit removal of the subsurface structure.
  - c) Excavations shall be shored, braced, and sheathed as conditions warrant. If close to existing pavement, sidewalks, curbs, pipes, railroads,

or structures of any kind, the excavation shall be secured by sheet piling or other methods so that such facilities and structures are protected.

- d) Boulders, logs, and any other debris encountered in the excavation shall be removed. When the material at the bottom of the excavation is unstable, it shall be removed and the space backfilled with granular material.
- e) Bedding material shall not be placed until the depth of excavation and the material at the bottom of the excavation has been approved.

B. Excavation for subsurface structures shall conform to the following:

- a) Pipes and Culverts. The width of trench shall be at least 18 inches greater than the outside diameter of the pipe or culvert.
- b) Excavation for trenches in embankments shall not proceed until the embankment has been constructed to an elevation of at least 3 feet above the proposed top of the pipe or culvert.
- c) Trench crossings shall be provided and maintained where necessary.
- d) Structures Other Than Pipes and Culverts. When the material at the bottom of the excavation is rock or other hard material, it shall be cleaned of all loose material and cut to a level surface.
- e) Backfill shall be made with excavated material in accordance with Subsection 02200, 6.8.
- f) Pipe and debris from removal of drainage structures, inlet and manhole castings shall be disposed of unless they are to be used on the Projects.

6.4 Removal of Sidewalks, Driveways, Curbs, and Gutters

- A. Concrete sidewalks, driveways, macadam basecoat and surface coat covering contaminated soil, vertical curbs, sloping curbs, barrier curbs, and gutters, designated for removal, shall be disposed of. Damage to adjacent pavement layers caused by removal operations shall be repaired without additional compensation.

6.5 Removal of Underground Storage Tanks

- A. Locations and types of underground storage tanks to be removed will be as shown on the plans.
- B. All work performed to remove and dispose of underground petroleum product storage tanks and piping systems, to sample and analyze soils and water, to dispose of or recycle contaminated soils, and to install and seal monitoring wells shall be in accordance with all appropriate municipal, State, and Federal regulations, and the following:
  - a) Permits and Approvals: The Contractor shall prepare and submit all documents to obtain all local permits and approvals necessary for this work. Tanks which are unregistered shall be registered by the Engineer. The charges to prepare the documents and the fees required for all permits, approvals, and registrations shall be paid by the Contractor.

- b) An underground storage tank closure plan application and standard reporting form shall be prepared and submitted to the Project Manager for review prior to submit to the state. State approval must be received prior to commencing removal operations.
- c) Contractor shall notify the Project Manager six weeks prior to the removal of underground tanks to allow for the Project Manager to obtain the EPA hazardous waste generator ID number for the tank contents.
- d) The Contractor shall notify the appropriate county health official in writing, with a copy to the Project Manager no less than one week in advance of the underground storage tank removal.
- e) The Contractor shall ensure that the waste disposal or recycling facility planned for receipt of the material is properly permitted to accept the material. A copy of the permit shall be submitted to the Project Manager one week prior to disposal or recycling.
- f) Removal Operations: The Contractor shall monitor the site with an explosimeter to indicate the presence and concentration of flammable vapors and gas. Should it be determined through this test that unsafe working conditions exist, the Project Manager shall be notified and removal operations shall be immediately suspended until it is determined that conditions are acceptable for resuming work.
- g) All liquids and sludge contained in the underground storage tanks and piping shall be removed prior to removing the tanks and associated piping systems from the ground and disposed of in accordance with the applicable hazardous waste regulations. Leakage from the tanks onto the surrounding soil shall be avoided by properly pumping the contents of the tanks into permitted transport vehicles. Should leakage or spillage occur, notification shall immediately be given to the Project Manager. The Contractor shall also notify the state and the county health department within 15 minutes. The Contractor shall be responsible for remediation of such leakage or spillage to the state's satisfaction in accordance with their investigation and corrective action requirements.
- h) Tank removal operations shall result in the least disturbance to the soil surrounding the tanks. Excavations shall be fenced with approved snow fencing. All tanks shall be free of vapors prior to transportation off-site. Excavated tanks and piping systems shall be removed from the site and disposed of properly.
- i) Should any evidence of discharge be apparent in the excavated hole, the Contractor shall notify the Project Manager and contact the state. The Contractor shall remove all free product contaminated soil from the excavation. Field tests to determine the extent of contaminated soils shall conform to the state requirements and shall be used to determine if additional soils must be excavated. Post excavation soil sampling and analysis shall then be conducted at the limits of the excavation.
- j) Prior to backfilling, any contaminated water not associated with ground water shall be removed and disposed of. When directed, the excavated hole shall be immediately backfilled.



- k) Manifesting and Transporting: The Contractor shall determine the appropriate EPA or state hazardous waste code and shall be responsible for all labeling and placarding.
- l) A uniform hazardous waste manifest (EPA FORM 8700-22) shall be completed by the waste hauler, as required by State Federal regulations. The Project Manager will sign this manifest as the generator. The appropriate number of generator copies of each manifest shall be given to the Project Manager before the shipment leaves the site.
- m) Transportation of the contents of the tanks shall be performed by a transporter who has a valid hazardous waste transporter's permit. Vehicles hauling the contents of the tanks shall be checked prior to leaving the site. No vehicle that is leaking shall be allowed to leave the site.
- n) One copy of each uniform hazardous waste manifest shall be returned to the Project Manager within two business days after notification of receipt at the disposal facility. If notification of receipt of any waste shipment is not received by the Contractor within two weeks of departure from the site, the Contractor shall immediately notify the Project Manager and contract the disposal facility to determine the status of the shipment and resolve the discrepancy. Any manifest discrepancies shall be reported to the Project Manager and be resolved by the Contractor.
- o) Storing Excavated Soil: Excavated soil shall be stockpiled on plastic sheeting having a minimum thickness of 6 mils. The stockpiled soil shall be covered with similar plastic sheeting which shall be held securely in place. The plastic sheeting shall be maintained or replaced as needed for as long as the material remains stockpiled. Stockpiles shall be located where excavation equipment can place the material directly from the excavation onto a stockpile. Where stockpiling of soil is not possible at the site, soil from the excavation shall be stockpiled at a site provided by the Contractor and approved by the Project Manager.
- p) Excavated soil shall be stored in such a manner that the soil is completely isolated from the environment and any hazardous materials in the soil are prevented from contact with or being released into the environment. Periodic inspections shall be made by the Contractor to ensure that the stockpiled soils are not released to the surrounding environment by erosion. Stockpiled soil shall not be stockpiled for more than 90 days.
- q) Composite soil sampling and analysis shall be conducted for the stockpiled soil. Stockpiled soil shall be analyzed by a state certified laboratory. Analyses shall also fulfill the requirements of the disposal facility.
- r) Recycling and Disposal of Contaminated Soil: The recycling or disposal of contaminated soil shall be in accordance with State and Local regulations and the waste management plan of the district of origin.
- s) The Contractor shall transport the contaminated soil to the recycling or disposal facility and shall obtain appropriate documentation which shall be provided to the Project Manager, the NDJEP, and the county of origin.

- t) Monitoring Wells: Installation, sampling, and analyses shall comply with all applicable standards.
- u) Upon receipt of approval from the Project Manager, the monitoring wells shall be sealed in accordance with all applicable standards.

#### 6.6 Sealing of Abandoned Wells

- A. Abandoned wells within the limits of clearing site shall be filled and sealed as follows:
  - a) Dug wells shall be filled in accordance with public health requirements.
  - b) Drilled wells shall be sealed in accordance with all applicable rules and regulations.
  - c) If an alternate method is proposed to seal the abandoned wells, written approval shall be secured from the agency with jurisdiction over said well and from the Project Manager.

#### 6.7 Clean-Up

- A. All paved areas being used by construction equipment and hauling operations shall be kept clean, free from mud and debris.
- B. Upon completion of the work, all surplus materials, debris, tools, and equipment shall be removed from the site.

#### 6.8 Backfill and Compaction

- A. Related Documents:
  - a) Drawings and general provision of Contract, including General and Supplementary Conditions apply to work of this section.
- B. Section Includes:
  - a) Site backfilling
  - b) Compaction requirements
  - c) Inspection and testing requirements
- C. Related Sections:

None
- D. Submittals:
  - a) By Contractor: One representative 50 lb sample of each imported material proposed for use as fill shall be delivered to the Soils Engineer prior to delivery to the Site. No backfill materials shall be delivered to the site until approved by the Soils Engineer.
  - b) By Soils Engineer who will be retained by the Design Consultant:
    - 1) Test Location Plan
    - 2) Soil Evaluation Report

- 3) Laboratory Test Reports
- 4) Certification of Compliance

E. Selected Fill Materials:

a) Structure Fill: Clean Fill, as defined by N.J.A.C. 7:26E-6.4:

- Fill shall be uncontaminated pursuant to any applicable remediation standard, free of extraneous debris or solid waste, and shall meet all applicable state, county, and local municipal standards.
- Documentation of the quality of the fill shall be provided by a certification stating that it is virgin material from a commercial or noncommercial source or decontaminated recycled soil.
- The bills of lading shall be provided to the Department to document the source(s) of fill. The documentation shall include:
  - The name of the affiant and relationship to the source of the fill;
  - The location where the fill was obtained, including the street, town, lot and block, county, and state, and a brief history of the site which is the source of the fill; and
  - A statement that to the best of the affiant's knowledge and belief the fill being provided is not contaminated pursuant to any applicable remediation standards and a description of the steps taken to confirm such.
- The use of Recycled Concrete Aggregate (RCA), or importing fill from another site, is not acceptable.

<u>US Standard Sieve Size</u>	<u>Percent Passing</u>
4 inch	100
No. 4	30 to 100
No. 200	0 to 12

- b) Material Availability: Borrow areas for structural fill material are not available on the site. Provide off-site materials of the quality specified and quantities required. Obtain material from a single source if possible. Request Design Consultant inspection of the borrow area(s) and obtain acceptance of the material proposed for use.

F. Common Fill Materials:

- a) Proof-roll subgrade to density requirements for backfill material.
- b) Cut out soft areas of subgrade not capable of compaction. Backfill with structural fill. Compact to density equal to requirements for fill below foundations founded on earth.
- c) Extend proof-rolling 5 feet beyond boundary of improvements.

H. Backfilling:

- a) Backfill areas to existing contours and elevation. Use unfrozen materials.

- b) Backfill systematically, as early as possible, to allow maximum time for natural settlement. Do not backfill over porous, wet, or spongy subgrade surfaces.
  - c) Place and compact select and fill materials in continuous layers not exceeding 8 inch loose depth.
  - d) Maintain optimum moisture content of backfill materials to attain required compaction density.
  - e) Make changes in grade gradual. Blend slopes into level areas.
  - f) Remove surplus backfill materials from site.
- I. Tolerances:
- a) Top Surface of Backfilling  $\pm 2$  inches or 0.17 feet.
- J. Testing Laboratory Services:
- a) The services of a Soils Engineer retained by the Design Consultant will be used to inspect, test, and approve the work.
  - b) Perform testing and analysis in accordance with the following:
    - 1) ASTM C136 – Sieve or Screen Analysis of Fine and Coarse Aggregate.
    - 2) ASTM D1557 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. Rammer and 18 inch Drop.
    - 3) ASTM D1556 – Density Test (Sand Cone Method), or ASTM D2167 – Density Test (Rubber Balloon Method), or ASTM D2922 – Density Test (Nuclear Method).  
*Method chosen is to be used consistently through completion of construction.*
  - c) Testing:
    - 1) Submit a plan for review, showing the location of each test.
    - 2) Perform sieve analysis to develop grain-size distribution curves for materials to be used for subgrade.
    - 3) Establish the moisture-density relation of soils to be used as fill.
    - 4) Determine moisture content of the fill materials before placement and advise the Contractor when it is unsuitable for required compaction.
    - 5) Perform field density test at each layer of compacted fill at locations adequate to evaluate the degree of compaction of all fill areas. There shall be at least one test at each layer for each 600 sq. ft. with a maximum spacing of 30 feet between test locations.

- 6) When required, design a blended soil matrix utilizing imported and/or on-site materials. Blended fill shall be equal to corresponding specified select fill.
- d) Inspection:
- 1) Inspect materials used and the placement and compaction of fills in general earthwork.
  - 2) Inspect proof-rolling operation to determine the presence of local soft pockets.
  - 3) Inspect the blending of on-site and/or imported fill material.
  - 4) Approve stockpiled fill that is to be reused either as common fill or structural fill.
  - 5) Verify that areas to be backfilled are free of debris, snow, ice, or water and that ground surfaces are not frozen.
- e) Soils Evaluation Report: Submit a written evaluation of all on-site materials for use as a structural fill.
- f) Laboratory Test Reports: Submit two (2) copies of each test report on a weekly basis. Include the following information:
- 1) Type and condition of soil at footing bottoms.
  - 2) Level of water table in the excavated areas.
  - 3) Grain size distribution of fill materials (average of 3 tests).
  - 4) Moisture density test results.
  - 5) Field density test results with moisture content and relative density of each layer of compacted fill. Include with field density test results, a plan showing location of each test.
- g) Certification: Submit certification, signed and sealed by a Registered Professional Engineer, that the work shown and specified has been performed in compliance with the Contract Documents.

K. Schedule of Locations:

The table below identifies locations and type of fill materials to be used. Where more than one material is required, the limits are defined from upper layer to lower layer. Place and compact materials in near-horizontal layers in lifts varying from 4 inches to 12 inches thick. The use of excavating equipment for compaction is not permitted. Lift thickness can be adjusted infield, pending type of compaction equipment and procedures used (see Compaction Equipment Table). Uniformly compact soil to percentages specified. Maximum layer is thickness of loose laid material prior to mechanical compaction. Percent compaction is percentage of maximum density as determine by ANSI/ASTM D-698.

LOCATION	MATERIAL	LIMITS	% COMPACTION
Below foundations founded on earth	Structural Fill	Full depth	98%
Below concrete slab	Crushed Stone Filter Fabric Structural Fill	8 Inches ----- Full Depth	95% ----- 98%
Within 3 feet of exterior side of foundation wall and site retaining walls	Crushed stone	Full Depth	95%
Beyond 3 feet of exterior side of foundation walls	Common Fill	Full Depth	93%
Below bituminous roadways	Aggregate Base Common Fill	See Drawings Full Depth	100% 98%/100%, upper 12"
Below Concrete paving	Aggregate Base Common Fill	See Drawings Full Depth	100% 98%/100%, upper 12"
Below Bituminous Parking Areas	Aggregate Base Common Fill	See Drawings Full Depth	100% 98%/100%, upper 12"
Over-excavated areas	Structural fill, or crushed stone as directed by Geotechnical Engineer	Full Depth	98%
Grassed areas	Topsoil Common Fill	6 inches Full Depth	Rolled 93%
Sodded Areas	Topsoil Common Fill	4 inches Full Depth	Rolled 93%
Landscaped Areas	Common Fill	Full Depth	93%
French Drains	Porous Fill wrapped with filter fabric	As Detailed on Plans	95%
Pipe Bedding (Class B)  Storm Sewers  Water Lines  Sanitary Sewers  Gas Line	Crushed Stone  Sand  Crushed Stone  ---	From 6" below the pipe to one half the diameter of the pipe.  From 3" below pipe to 6" above pipe  From 6" below pipe to 24" above pipe  None Required	95%
Pipe Backfill	Common fills approved by Geotechnical Engineer	From pipe bedding to finished subgrade	95%

Special Bedding for underground HVAC Pipes	Common Fill	From subgrade to 6" above pipe	95%
	Sand	From 6" above pipe to 6" below pipe	95%
	Crushed Stone	From 6" below pipe to 10" below pipe	98%

L.        Compaction Equipment Table

MAXIMUM LAYER THICKNESS (INCHES)*		
TYPE OF COMPACTION EQUIPMENT	GRANULAR SOIL (SAND AND GRAVEL, DGE, ETC.)	COHESIVE SOIL (LEAN SAND CLAY, SILTY CLAY, ETC.)
Hand Operated Vibratory Place	4 inches	N/A
Hand Operated "Jumpin' Jack" (in confined spaces)	N/A	4 inches
Walk-Behind Double Drum Vibratory Flatwheel Roller	6 inches	N/A
Walk-Behind Double Drum Sheepsfoot Roller	N/A	4 inches
5 to 10 Ton Vibratory Flatwheel Roller	8 inches	N/A
5 to 10 Ton Vibratory or Static Sheepsfoot Roller	N/A	8 inches
20+ Ton Self-Propelled Vibratory Flatwheel Roller	12 inches	N/A
20+ ton Self-Propelled Vibratory or Static Sheepsfoot Roller	N/A	8 inches

\* Based on fill soil at optimum conditions  
N/A = Not Applicable

END OF SECTION 311000





## SECTION 312001 – EARTHWORK

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Earth moving and excavation.
  - 2. Rock removal.
  - 3. Grading.
  - 4. Backfilling.
  - 5. Filling.
  - 6. Compacting.
- B. Related Documents:
  - 1. Geotechnical data: Bidding documents.
- C. Related Sections:
  - 1. Section 321614 - Concrete Site Work

#### 1.02 UNIT PRICES

- A. Earth Excavation: Removal, reuse, and disposal of earth and other naturally occurring or man-made materials encountered other than materials classified as rock or unnecessary excavation.
  - 1. Payment: No separate payment will be made for earth excavation. The cost of earth excavation shall be included in the cost of general construction.
- B. Rock Excavation: Excavation and disposal of rock material occurring as boulders or in beds, ledges, un-stratified masses, and conglomerate deposits and which cannot be removed by the excavating equipment referenced below without the aid of systematic drilling and blasting. Drilling or blasting in order to increase productivity will not be cause for classification of materials as rock excavation.
  - 1. Excavating equipment for trenches and pits: Late-model track-type excavator with a short stick, a rock bucket, and an operating weight of at least 40,000 pounds.
    - a. Open excavation includes trenches over 10 feet wide and pits greater than 30 feet in length or width.
  - 2. Excavating equipment for open excavations: Late-model track-type loader with an operating weight of at least 50,000 pounds and a rock bucket having at least 41,000 pounds break-out force.
  - 3. Measurement: Perform rock excavation only after material has been cross-sectioned and classified, and after approval has been obtained.
  - 4. Measurement of rock excavation shall be the volume actually removed but shall in no case exceed the following:
    - a. Two feet outside of concrete forms other than at footings.
    - b. One foot outside of concrete forms for footings.
    - c. Six inches outside of required minimum dimensions of concrete cast against grade.
    - d. Required subgrade elevation beneath concrete slabs on grade, and allowing for capillary water barrier, where required.
    - e. Trench depth, 6 inches beneath pipe inverts; trench width, the greater of pipe diameter plus two feet, or 42 inches.
  - 5. Payment: Rock excavation will be paid on the basis of unit prices included in the contract documents. The unit price paid for rock excavation includes its replacement with approved materials.

### 1.03 REFERENCES

- A. ASTM D 698-91 -- Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)); 1991.
- B. ASTM D 1556-90 -- Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 1990.
- C. ASTM D 2167-94 -- Standard Test Method for Density and Unit Weight of Soil In-Place by the Rubber Balloon Method; 1994.
- D. ASTM D 2487-93 -- Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System); 1993.
- E. ASTM D 2922-91 -- Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 1991.
- F. ASTM D 3017-88(93) -- Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 1988 (Reapproved 1993).

### 1.04 SUBMITTALS

- A. Product Data: Plastic marking tape.
- B. Test Reports: Testing laboratory shall submit the following reports directly to the architect and shall copy the contractor:
  - 1. Analysis of soil materials, whether procured on or off site, and including fill, backfill, and borrow materials.
  - 2. In-place density test reports.
  - 3. Moisture-density relationship test reports.
  - 4. Compressive strength or bearing test reports.

### 1.05 QUALITY ASSURANCE

- A. Testing Laboratory Services:
  - 1. Secure and pay for the services of a qualified, independent geotechnical engineer to classify existing soil materials, to recommend and to classify proposed borrow materials when necessary, to verify compliance of materials with specified requirements, and to perform required field and laboratory testing. Geotechnical engineer shall be acceptable to the architect and the owner and shall be licensed to practice in the state in which the project is located.

### 1.06 SITE CONDITIONS

- A. Traffic: Do not interfere with or close public ways without permission of governing authorities. Do not interfere with adjacent private facilities.
- B. Site Utilities:
  - 1. Advise utility companies of excavation activities before starting excavations. Locate and identify underground utilities passing through work area before starting work.
  - 2. If underground utilities are encountered in locations other than indicated, immediately advise utility owners before proceeding. Amend project record documents to show actual locations.
  - 3. Protect existing utilities indicated to remain.
  - 4. Do not interrupt existing utilities without advance notice to and written approval from the owner.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Where sufficient approved materials are not available from required excavations on site, obtain and pay for materials from approved sources off site without charge to the owner.
- B. For each soil material proposed for use as fill or backfill, whether obtained on or off site, testing laboratory shall classify soil material, develop Proctor curve, and perform any other tests required.
- C. Obtain approval of the architect for each soil material.
- D. Backfill and Fill Materials: Materials classified as satisfactory.
- E. Satisfactory Soil Material (ASTM D 2487): Free of stones larger than 2 inches in any dimension, trash, debris, organic material, other objectionable material and classified as follows:
  - 1. GW (well-graded gravel).
  - 2. GP (poorly graded gravel).
  - 3. GM (silty gravel).
  - 4. SW (well-graded sand).
  - 5. SM (silty sand).
- F. Unsatisfactory Soil Material (ASTM D 2487):
  - 1. GC (clayey gravel).
  - 2. SP (poorly graded sand).
  - 3. SC (clayey sand).
  - 4. CL (lean clay).
  - 5. ML (silt).
  - 6. OL (organic clay).
  - 7. OL (organic silt).
  - 8. CH (fat clay).
  - 9. MH (elastic silt).
  - 10. OH (organic clay).
  - 11. OH (organic silt).
  - 12. PT (peat).
- G. Capillary Water Barrier: Clean, crushed rock or gravel or uncrushed gravel; 100 percent passing a 1-1/2-inch sieve; not more than 2 percent passing a No. 4 sieve.
- H. Subbase Material: Well-graded, clean, sound, durable particles of crushed stone, crushed blast furnace slag, or crushed gravel, and screenings. Obtain the architect's approval of source, quality, and gradation.
- I. Recycled Concrete Aggregate/Recycled Asphalt Pavement: The use of recycled concrete aggregate or recycled asphalt pavement, or any blend of these materials, with or without soil or quarry process stone shall not be permitted.

### 2.02 PLASTIC WARNING TAPE

- A. Acid- and alkali-resistant polyethylene film specifically manufactured for marking and identifying underground utilities.
  - 1. Minimum width, 6 inches; minimum thickness, 4 mils.

2. Metallic core encased in protective jacket against corrosion and detectable by metal detector when tape is buried 3 feet deep.
3. Continuous printed inscription shall describe utility.  
Tape color:
  - a. Electric: Red.
  - b. Pipeline: Yellow.
  - c. Water system: Blue.
  - d. Sewer: Green.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Protection: Provide markers indicating limits of work and clear identification of items and areas requiring protection.
- B. Provide barricades, warning signs, and warning lights around open excavations as necessary to prevent injury to persons.
- C. The contractor is solely responsible for determining the potential for injury to persons and damage to property.
  1. Where such potential is present, take appropriate protective measures.
  2. Protect persons from injury and protect existing and new improvements from damage caused directly or indirectly by construction operations.
- D. Do not allow excavation subgrades and soil at foundations to be subjected to freezing temperatures or frost. Provide protective insulating materials as necessary. Should prepared, compacted subgrades be damaged by freezing, remove soil materials to the depth required by the architect and replace and recompact in conformance with specified requirements.

### 3.02 EROSION CONTROL

- A. To the maximum extent practicable, prevent erosion or displacement of soils and discharge of soil-bearing water runoff to adjacent properties and waterways.
- B. Provide erosion control during the entire project in accordance with applicable regulations.

### 3.03 PROTECTION OF TREES

- A. Provide temporary guards to protect trees and vegetation to remain. Place guards so as to prevent all forms of vehicular traffic or parking within drip lines.
  1. Do not allow excess foot traffic within drip lines.
  2. Do not stockpile construction materials, soil, or aggregates within drip lines.
  3. Water trees and other vegetation to remain within limits of the area of construction activities as required to maintain their health during course of construction operations.
- B. Engage a qualified arborist to remove branches or roots to the extent required by this specification or shown on the drawings.
- C. Excavate within drip line of trees only where indicated.
- D. Where underground utilities must pass within drip line, hand-dig tunnels to avoid cutting main lateral roots and taproots. Minor roots may be cut only when necessary.

1. Where root system is damaged or cut back, prune branches to maintain root/branch balance.
- E. Immediately protect exposed roots until reestablishment in backfill. Cover with approved mulching material and keep continuously moist.
- F. Raising Grades:
  1. Minor fills less than 6 inches: Place specified topsoil without compacting, and finish grade by hand.
- G. Where cutting is required, cut branches and roots using properly sharpened tools and without breaking members.
- H. Promptly repair any damaged trees to prevent death or loss of vigor.
  1. Where the contractor's operations result in dead or severely damaged trees, remove trees and provide new trees of similar size, except provide 6-inch-caliper trees to replace existing trees over 6 inches caliper.
    - a. Species as selected by the architect.
  2. Do not add more than 2" of additional fill above the root system of existing trees. Any additional fill can result in the death of the tree.

#### 3.04 DEWATERING

- A. Do not allow surface or ground water to flow into or accumulate in excavations.
- B. Do not allow water to flow in an uncontrolled fashion across the project site or to erode slopes or to undermine foundations. Do not allow water to be diverted onto adjacent properties. Arrange excavation operations so as to provide continual and effective drainage of excavations.
- C. Provide and maintain temporary diversion ditches, dikes, and grading as necessary; do not use trench excavations for this purpose. When required by surface or subsurface water conditions, provide sumps, wellpoints, French drains, pumps, and other control measures necessary keep excavations free of water. When existence of ground water near or above final excavation level is indicated or suspected, provide control measures prior to excavating to water level and maintain water level continuously below working level.

#### 3.05 EXCAVATION

- A. Explosives: Do not use explosives.
- B. General: Excavation includes the removal of any materials necessary to achieve the required subgrade elevations and includes reuse or disposal of such materials.
- C. Unnecessary Excavation: The expense of excavation of materials outside of limits indicated or ordered in writing by the architect and the correction thereof to the satisfaction of the architect shall be borne by the contractor. Either place compacted fill or otherwise correct conditions, as required by the architect/engineer.
- D. Approval of Subgrade: Notify the architect when required elevations have been reached.
  1. When required by the architect due to the unforeseen presence of unsatisfactory materials or other factors, perform additional excavation and replace with approved compacted fill material in accordance with the architect's instructions.
  2. Payment for unforeseen additional work will be made in accordance with established unit prices or, if none, in accordance with provisions for changes in the work. No payment will be made for correction of subgrades improperly protected against

damage from freeze-thaw or accumulation of water, or for correction of otherwise defective subgrades.

- E. Excavation Stabilization: Wherever it is possible to slope faces of excavations to achieve stabilization, do so in compliance with requirements of governing authorities. Otherwise, provide shoring and bracing.
  - 1. Design, provide, maintain, and remove shoring and bracing in compliance with requirements of governing authorities. Remove temporary shoring and bracing when stabilization is no longer required.
- F. Excavation for Pavements: Excavate, shape, and compact to the lines, subgrade elevations, and cross sections indicated.

### 3.06 STORAGE

- A. Stockpile materials to be used for filling and backfilling, including excavated materials classified as satisfactory soil materials, at locations indicated or as directed. Stockpile in a manner to freely drain surface water; cover if necessary to prevent wind-blown dust.
  - 1. Store soil materials without intermixing. Protect from contamination with other soils or debris.
  - 2. Do not stockpile materials inside of drip line of trees to remain.

### 3.07 PLASTIC WARNING TAPE

- A. Install tape directly above utilities, 18 inches below finished grade

### 3.08 BACKFILLING

- A. Preparation: Backfill excavations as soon as practicable. Complete the following operations before backfilling:
  - 1. Inspection and acceptance of below-grade construction.
  - 2. Inspection, testing, and approval of underground utilities.
  - 3. Surveying of underground utilities for record documents.
  - 4. Concrete formwork removal.
  - 5. Removal of loose material, muck, debris, and trash from excavation.
  - 6. Installation of temporary or permanent horizontal bracing for structures to receive backfill.
- B. Remove temporary shoring and bracing as the work progresses and when its use is no longer necessary.
- C. Installation: Place approved soil materials in layers to required elevations.
  - 1. Do not place material on muddy or frozen surfaces or on surfaces containing frost.
- D. Installation: Place satisfactory soil materials in layers to required subgrade elevations.
- E. Recycled Concrete Aggregate/Recycled Asphalt Pavement: The use of recycled concrete aggregate or recycled asphalt pavement, or any blend of these materials, with or without soil or quarry process stone shall not be permitted.

### 3.09 FILL

- A. General: All areas to receive fill shall be leveled. The surface shall be free from ruts, hummocks, or other uneven features which would tend to prevent uniform compaction by the equipment utilized. If placed, the stone drainage blanket shall consist of 3/4" size crushed stone and be uniformly spread over the bottom of the excavation. The average thickness of the drainage blanket shall be 15". Sump pits shall be set as required to control

the water level in the blanket. Pumps shall be used to maintain the water level a minimum of 12" below the surface of the fill. Material for controlled fill in building areas and extending five feet beyond the building limits shall preferably consist of clean sand and/or gravel, free of vegetable matter or other deleterious substances. The sand and/or gravel shall be well graded and shall contain no more than 70% by weight of material finer than the No. 30 sieve and no more than 15% by weight of material finer than the No. 200 sieve. Boulders and cobbles having a maximum diameter exceeding six inches shall be excluded from the fill material. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.

In excavations, use satisfactory excavated or borrow material.

Under grassed areas, use satisfactory excavated or borrow material.

Under building slabs, use drainage fill material.

Under piping and conduit, use subbase material where subbase is indicated under piping or conduit; shape to fit bottom 90 degrees of cylinder.

Underground electrical conduit, encase the conduit in 1' of white sand.

Backfill excavations as promptly as work permits, but not until completion of the following:

Acceptance of construction below finish grade including, where applicable, damp-proofing, waterproofing and perimeter insulation.

Inspection, testing, approval, and recording locations of underground utilities.

Removal of concrete formwork.

Removal of trash and debris.

- B. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

- C. Placement and Compaction: Place backfill and fill materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment, and not more than 4" in loose depth for material compacted by hand-operated tampers.

Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

The surface of the fill shall be kept at a slight slope to facilitate drainage of any ground or surface water which enters the excavation. Sump pits and pumps shall be used, if required, to maintain the fill in a reasonably dry condition.

After each layer has been placed and spread evenly, it shall be thoroughly compacted to an average value of 95% of the maximum Modified Proctor density of the soil being utilized

within the building areas and extending five feet beyond the building limits in all directions. No individual test values shall be acceptable if they are below 90%. If required, the maximum density of the material shall be determined by a Soils Engineer in accordance with the American Society for Testing and Materials (ASTM) D 1557, latest edition. Cost for testing will be borne by the contractor at no additional cost to the owner.

A smooth-wheeled vibratory compactor should provide the most suitable means of compaction of essentially non-cohesive granular soils. Small, portable rammer or vibratory plate compactors should be utilized within five feet of existing walls.

Sufficient passes of approved compactor shall be made in order to obtain the specified densities. A minimum of three passes of the compactor shall be required over all portions of each lift. A "pass" shall be defined as one passage of the contact portion of the compactor over the entire surface of the layer.

Place backfill and fill materials evenly adjacent to structures, piping or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.

### 3.10 PAVEMENT SUBBASE COURSE PLACEMENT

- A. Place lifts such that compaction true to grade and level is accomplished with a minimum of surface disturbance and segregation or degradation of materials. Maintain grade control and cross section by means of line and grade stakes. Maintain moisture content within prescribed limits during placing and compacting.
- B. When the total thickness of subbase is less than the maximum lift thickness permitted, place material in a single lift. When the total thickness of subbase is greater than the maximum lift thickness permitted, place materials in two or more lifts of uniform thickness with no lift less than 3 inches in thickness.
- C. Place material along the edges of the subbase course so as to maintain compaction of the subbase course. Construct at least a 1-foot width of shoulder simultaneously with each lift of the subbase course.
- D. Cut any overbuild to grade. Should top elevation be lower than allowable tolerances, scarify to a depth of 3 inches, add new material, and recompact to bring to grade within required tolerances.

### 3.11 COMPACTION

- A. Place materials used in backfilling and filling in layers not exceeding loose depths as follows:
  - 1. Heavy equipment compaction: 8 inches.
  - 2. Hand-operated tampers: 4 inches.
- B. Place material simultaneously on opposite sides of walls, small structures, utility lines, etc. to avoid displacement or overstressing.
- C. In-Place Density Requirements: Compact soil to not less than the values given below, expressed as a percentage of maximum density at optimum moisture content.
  - 1. Unpaved areas: Top 6 inches of subgrade and subsequent lifts:
    - a. 90 percent.



2. Paved areas: Top 12 inches of subgrade and subsequent lifts:
    - a. 95 percent.
  3. Exterior steps and ramps: Top 8 inches of subgrade and subsequent lifts:
    - a. 95 percent.
- D. Moisture Control: During compaction, control moisture subgrades and subsequent lifts to within tolerances from optimum moisture content as recommended by testing laboratory. Wet surface with water when additional moisture is required. Aerate soil to aid in drying or replace soil when excessive moisture is present.

### 3.12 GRADING

- A. General: Smooth grade to a uniform surface that complies with compaction requirements and required lines, grades, and cross sections and is free from irregular surface changes.
- B. Provide smooth transition between existing adjacent grades and changed grades. Cut out soft spots, fill low spots, and cut down high spots to conform to required surfaces tolerances.
- C. Slope grades to direct water away from structures and to prevent ponding. Finish subgrade to required elevations within the following tolerance:
  1. Unpaved areas: Plus or minus 0.10 foot.
  2. Paved areas: Plus or minus 0.05 foot.
  3. Exterior steps and ramps: Plus or minus 0.05 foot.
  4. Inside building lines: 1/2 inch as measured with a 10-foot straightedge.

### 3.13 PROOF ROLLING

- A. After completion of required compaction and immediately prior to proceeding with subsequent construction, proof roll in the presence of testing laboratory representative.
  - B. Proof roll using a heavy pneumatic-tired vehicle having four tires abreast, each tire loaded to 30,000 pounds and tire inflated to 150 psi. Provide 30 coverages of the area to be proof rolled, one coverage being defined as the application of one tire print over the entire area. Maintain optimum moisture content during proof rolling. In areas which show pumping or which are otherwise unsatisfactory, undercut fill material and replace with compacted fill, or stabilize in place, as required by the architect.
- E. Proof roll Areas to Receive:
1. Pavement.

### 3.14 EXCAVATION FOR TRENCHES

- A. Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 6" to 9" clearance on both sides of pipe or conduit.
- B. Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.
- C. Where rock is encountered, carry excavation 6" below required elevation and backfill with a 6" layer of crushed stone or gravel prior to installation of pipe.

- D. For pipes or conduit 5" or less in nominal size and for flat-bottomed multiple-duct conduit units, do not excavate beyond indicated depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
- E. For pipes or conduit 6" or larger in nominal size, and electrical work indicted to receive subbase, excavate to subbase depth indicated, or, if not otherwise indicated, to 6" below bottom of work to be supported.
- F. Except as otherwise indicated, excavate for exterior water-bearing piping (water drainage) so top of piping is not less than 3' below finished grade.
- G. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.
- H. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.

### 3.15 FIELD QUALITY CONTROL

- A. Testing Laboratory Services: Provide timely notice to testing laboratory. Do not proceed with construction until testing of each subgrade and lift of fill or backfill has been performed and required inspections and approvals have been obtained.
- B. Maximum Density at Optimum Moisture Content: Determine in accordance with ASTM D 698.
  - 1. For each subgrade, fill, and backfill material, perform one moisture-density relationship test for each 1500 cubic yards, or fraction thereof, of material used.
- C. In-Place Density Tests: ASTM D 1556 (sand cone method), ASTM D 2167 (rubber balloon method), or ASTM D 2922 (nuclear method), as applicable.
  - 1. When ASTM D 2922 is used, check and adjust calibration curves using ASTM D 1556 only. ASTM D 3017 shall be performed to measure water content of soil at the time in-place density tests are conducted. Calibrate density and moisture gages at the start of testing on each type of material encountered and at intervals as directed.
- D. Areas under Slabs and Pavements: Conduct not less than one in-place density test of subgrade and one in-place density test of each compacted fill or backfill layer for every 2000 square feet of overlying paved area, but in no case less than 3 tests per lift.
- E. If testing service reports indicate that subgrade or fills are below specified density, scarify or remove and replace to the required depth, recompact, and retest at no cost to the owner.
- F. Lab and field testing costs to be paid for by the Contractor.

### 3.16 MAINTENANCE

- A. Completed Areas: Protect from damage by pedestrian or vehicular traffic, freezing, erosion, and contamination with foreign materials.
  - 1. Repair and re-establish grades to specified tolerances in settled, eroded, or rutted areas.
- B. Damaged Areas: Where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction and whether due to subsequent construction operations or weather conditions, restore materials to required conditions: Scarify or remove and replace to the required depth, return to optimum moisture content, and compact materials to the required density before continuing construction.

- C. Correction: Should settling occur within the project correction period, remove finished surfacing, add additional approved material, compact material, and reconstruct surfacing. Construct surfacing to match and blend in with adjacent surfacing as nearly as practicable.

### 3.17 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Remove any material not required for use on the project (including unsatisfactory soil, excess satisfactory soil, milled or removed pavement, removed concrete, trash, and debris) and legally dispose of it off the owner's property.

### 3.18 QUALITY ASSURANCE

- A. Safety Codes and Standards: Perform earthwork and site grading work in compliance with the applicable requirements of governing authorities having jurisdiction.
- B. Provide and maintain barricades, signs, lights, etc., required for the protection of personnel, tenants, the public, materials, etc. Barricades where applicable shall conform to all the local codes and regulations and shall be removed upon completion of the contract.
- C. The Contractor shall be solely responsible for stability of excavation and shall provide all sheathing, lagging, bracing, etc., required to retain the excavations and to prevent slides sloughs.

END OF SECTION 312001



## SECTION 312318 - SITE TRENCHING

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Trench excavation, backfill and compaction of underground piping and underdrainage.

#### 1.02 RELATED SECTIONS

- A. Section 331116 – Site Water Utility Distribution Piping
- B. Section 333100 – Sanitary Utility Sewerage Piping
- C. Section 334100 – Storm Utility Drainage Piping
- D. Section 334600 – Subdrainage

#### 1.03 SUBMITTALS

- A. Comply with the requirements of Division 01 – Submittal Procedures and as modified below.
- B. Backfill Product Data: Submit test reports for each type of gravel and/or stone specified for backfill naming the source of each material. Submit evidence that each backfill material complies with Department of Transportation standard specifications for the materials specified.
- C. Quality Control Submittals
  - 1. Experience Listing: Submit a list of completed projects similar to this project, including owner's contact information and telephone number for each project.
- D. Closeout Procedures: Comply with the requirements of Division 01.

#### 1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Obtain written permission from applicable agencies prior to the start of construction. Submit one copy of the permit as specified in "Submittals-Quality Control Submittals" above.

#### 1.05 PROJECT CONDITIONS

- A. Field Measurements: Establish and maintain required lines and elevations for grade control.

#### 1.06 SEQUENCING AND SCHEDULING

- A. Proceed with and complete trenching operations as rapidly as portions of the site become available, working within seasonal limitations for the work required.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Excavated Material: Utilize on-site excavated materials consisting of loam, clay, sand, gravel or other material suitable for backfilling as approved by the Project Designer when the type of backfill material is not indicated on the Contract Documents.
- B. Sand: Natural bank sand complying with the following gradation requirements:
1. 100% passing the  $\frac{3}{4}$ " sieve
  2. Less than 5% passing the Number 200 sieve.
- C. Select Type 1 Granular Material: Where indicated supply stockpiled, sound, durable, sand, gravel, stone, or blends of these materials, free from organic and other deleterious materials. Comply with New Jersey State Department of Transportation gradation and material requirements specified below:

Sieve		Percent Passing
Sieve Size	Size opening (mm)	
3 inch	76.2	100
2 inch	50.8	90-100
1/4 inch	6.35	30-65
No. 40	0.425	5-40
No. 200	0.075	0-10

- D. Bedding Material: Mixture of 50% No. 1 and 50% No. 2 stone complying with the following New Jersey State Department of Transportation Standard Specifications:

No. 1 Stone Gradation Requirements

Sieve		Percent Passing
Sieve Size	Size opening (mm)	
1 inch	25.4	100
1/2 inch	12.70	90-100
1/4 inch	6.35	0-15
No. 200	0.075	0-1

No. 2 Stone Gradation Requirements

Sieve		Percent Passing
Sieve Size	Size opening (mm)	
1 ½ inch	38.1	100
1 inch	25.4	90-100
1/2 inch	12.7	30-65
No. 200	0.075	0-10

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Installer Verification of Conditions: Examine conditions under which trenching operations are to occur with the materials and components specified in this section. Affected Prime Contractors, the Owner's Representative and the Project Designer shall be notified in writing of any conditions detrimental to the proper and timely installation of the work.

1. When the installer confirms conditions as being acceptable to ensure proper and timely installation of the work and to ensure requirements of applicable warranties or guarantees can be satisfied, submit written confirmation to the Project Designer. Failure to submit written confirmation and subsequent installation will be assumed to indicate conditions are acceptable to the installer.

### 3.02 EXCAVATION

- A. Excavate trenches to line and depth as indicated on the Contract Documents. Provide consistent, uniform support for the bottom quadrant of each section of piping, fittings and associated materials.
  1. Excavate no more than length of trench that can receive infrastructure installation and backfill.
  2. Brace and drain trenches as required. Accumulations of groundwater or storm runoff shall be immediately discharged by dewatering pumps to siltation basins or protected channels, drains or storm sewers.
  3. Provide adequate trench width to permit successful laying and joining of pipe, proper placement of backfill and clearance of at least 8" on either side of the pipe barrel.
  4. Prepare the finish grade of the trench bottom with hand tools. Where elevations are not shown on the Contract Documents, excavate the trench to place a minimum of 18" of fill above the top of the pipe. Provide "bell holes" at each pipe joint for proper joining to eliminate point bearing. Stones of 2" or greater in any dimension or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.
  5. Where trench excavation is carried below the specified elevation as a result of Contractor error or negligence, backfill the trench with Select Type 1 Granular Material and compact to required densities at no cost to the Owner.
  6. When trenching is required within the dripline of trees, tunnel under or around roots by hand digging. Do not cut tap roots or main lateral roots.
- B. Rock Excavation: Comply with the requirements outline in Project Manual Section 312001-Earthwork.
- C. Excavated Materials
  1. Materials satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench sufficient to avoid overloading and to prevent slides and cave-ins.
  2. Adequate drainage shall be provided for the stockpiles and surrounding areas by means of ditches, dikes and other approved methods.
  3. Stockpiles shall be protected from contamination with unsatisfactory excavated material or other material that destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles and any material becomes unsatisfactory as a result, such material shall be removed and replaced with satisfactory on site or imported materials from approved sources at no additional cost to the Owner.
  4. Excavated material not required or not satisfactory for backfill shall be removed from the site.

### 3.03 BACKFILLING

- A. Trench Backfill: Trenches shall be backfilled to grade upon completion of required testing work.

- B. Bedding and Initial Backfill: Bedding shall be of the type and thickness as indicated on the Contract Documents or as recommended by the pipe manufacturer.
1. Initial backfill material shall be placed in layers of a maximum of 6" loose thickness and compacted with approved tampers to the density of the adjacent in-situ soil, and to a height of at least one foot above the utility pipe, conduit or other infrastructure item. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe.
  2. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.
- C. Final Backfill: The remainder of the trench shall be backfilled with satisfactory material removed from the trench. Backfill material shall be deposited and compacted as follows:
1. Under building slabs, roads, walks, parking lots and other structural areas, backfill shall be deposited in maximum 8" loose thickness layers and compacted to 95% maximum dry density at +/-2% of optimum moisture content.
  2. Under tracks, tennis courts and other structural athletic areas, backfill shall be deposited in maximum 8" loose thickness layers and compacted to 95% maximum dry density at +/-2% of optimum moisture content.
  3. Under synthetic turf playfield areas, backfill shall be deposited in maximum 8" loose thickness layers and compacted to 95% maximum dry density at +/-2% of optimum moisture content.
  4. Under general landscape and natural turf playfield areas, backfill shall be deposited in maximum 12" loose thickness layers and compacted to 95% maximum dry density at +/-2% of optimum moisture content.

### 3.04 FIELD QUALITY CONTROL

- A. Testing
1. The Owner may provide soil testing and inspection services during the backfill of trenches as outlined in Project Manual Section 014000 – Quality Requirements.
  2. Prime Contractors shall employ the services of an independent testing agent to observe and test backfill operations performed by other Prime Contractors that may affect their work. An independent testing laboratory shall certify that the backfill is suitable for finish construction to be installed over trenches.
  3. Prime Contractors shall submit copies of testing laboratory reports to the Owner's Representative and the Project Designer for information only.
  4. The General Work and Site Work Prime Contractors shall accept in writing any trench backfill and compaction by other prime contractors before installing the remaining finish construction over trench work.

END OF SECTION 312318



## SECTION 312319 – DEWATERING

### PART 1 - GENERAL

#### 1.1 GENERAL

- A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area. Dewatering shall be included in the project bid price. Separate payment will not be made for dewatering.
- B. The contractor shall furnish sufficient pumping or other dewatering equipment and shall provide, at his own expense, satisfactory drainage whenever needed to the trench and other excavation during the progress of the work and at its completion for final inspection. No structures or pipe sewers shall be laid in water, and water shall not be allowed to flow over or raise upon any concrete, masonry, or pipe sewers until the work has been inspected and the mortar or concrete has properly set.
- C. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
- D. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
- E. Where a continuous flow of water into the trenches causes a soft condition and where pumping cannot dry and prevent the flow of water in the trench, the contractor shall furnish, install, and maintain an efficient well point system.
- F. Materials and workmanship used for the wellpoint system shall be in keeping with approved standard practice. The wellpoint system shall function so as to enable pipe, concrete foundations, and appurtenances to be installed without interference from running or standing water at the bottom of the excavation. The engineer shall make the final decision as to the acceptability of the wellpoint system or any part thereof.
- G. Where necessary, pea gravel or graded sand shall be used in conjunction with the wellpoints as they are installed to insure continuous pumping in dewatering fine material.
- H. The wellpoint system shall be operated after the structures have been installed, as long as necessary, in order to construct manholes, install pipe and/or properly install the footings and foundations.

#### 1.2 DISPOSAL OF WATER

- A. All water pumped or bailed from the trench or other excavation shall be conveyed in a proper manner to a suitable point of discharge by the contractor at his own expense.

END OF SECTION 312319



## SECTION 313117 – SOIL CONSERVATION

### PART 1 - GENERAL

1.01 Description of Work: The extent of the soil conservation work is shown on the drawings and schedules. Sediment fence details, inlet filter details, construction sequence, and seeding schedules required are shown on the drawings.

The contractor shall comply with all soil erosion and sediment control practices in accordance with the "New York State Standards and Specifications for Erosion and Sediment Control", and as directed by the local Soil Conservation District representative and the architect.

END OF SECTION 313117



## SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

### 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 temporary excavation support and protection systems.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

#### 1.4 FIELD CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of utility.
  - 2. Do not proceed with interruption of utility without Owner's written permission.
- B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Provide, design, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads.
  - 1. Contractor Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer.
  - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
  - 3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
  - 4. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

## 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 that could develop during excavation support and protection system operations.
  - 1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, 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.
- C. Locate excavation support and protection systems clear of permanent construction so that construction and finishing of other work is not impeded.

### 3.2 SOLDIER PILES AND LAGGING

- A. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- B. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

### 3.3 FIELD QUALITY CONTROL

- A. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.
- B. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

### 3.4 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.
  - 1. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 315000

## SECTION 321313 – BITUMINOUS CONCRETE PAVING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Bituminous concrete paving.
- B. Related Sections:
  - 1. Earthwork: Elsewhere in Division 31.

#### 1.2 REFERENCES

- A. AASHTO M 17-88 -- Standard Specification for Mineral Filler for Bituminous Paving Mixtures; 1988.
- B. AASHTO M 20-70 (1990) -- Standard Specification for Penetration Graded Asphalt Cement; 1970 (Reapproved 1990).
- C. AASHTO M 140-88 -- Standard Specification for Emulsified Asphalt; 1988.
- D. AASHTO M 208-87 -- Standard Specification for Cationic Emulsified Asphalt; 1987.
- E. AASHTO M 226-80 (1986) -- Standard Specification for Viscosity Graded Asphalt Cement; 1980 (Reapproved 1986).
- F. AI MS-2 -- Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; Asphalt Institute; 1993.
- G. AI MS-8 -- Asphalt Paving Manual; Asphalt Institute; 1987.
- H. ASTM D 242-85(90) -- Standard Specification for Mineral Filler for Bituminous Paving Mixtures; 1985 (Reapproved 1990).
- I. ASTM D 692-94a -- Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures; 1994.
- J. ASTM D 946-82 (93) -- Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 1982 (Reapproved 1993).
- K. ASTM D 977-91 -- Standard Specification for Emulsified Asphalt; 1991.
- L. ASTM D 1073-94 -- Standard Specification for Fine Aggregate for Bituminous Paving Mixtures; 1994.
- M. ASTM D 2027-76(86) -- Standard Specification for Cutback Asphalt (Medium-Curing Type); 1976 (Reapproved 1986).
- N. ASTM D 2397-91 -- Standard Specification for Cationic Emulsified Asphalt; 1991.
- O. ASTM D 3381-92 -- Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction; 1992.
- P. ASTM D 3515-89 -- Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures; 1989.

Q. FS TT-P-115F -- Paint, Traffic (Highway, White and Yellow); 1984.

### 1.3 SYSTEM DESCRIPTION

A. Furnish and construct asphalt concrete pavement in accordance with requirements of contract documents.

### 1.4 SUBMITTALS

A. Mix Design:

1. Submit for approval each job-mix formula proposed for work of this section.

B. Approved Mix:

1. Furnish certification by authorities having jurisdiction, of approval of job-mix formula proposed for work of this section.

### 1.5 QUALITY ASSURANCE

A. Testing and Inspection:

1. The contractor will engage an independent testing and inspection agency to perform quality control procedures and to prepare test reports.

### 1.6 PROJECT CONDITIONS

A. Environmental Requirements:

1. Prime coat application:

a. Minimum ambient temperature for 12 hours immediately preceding the application: 35 degrees F (1 degree C).

b. Minimum ambient temperature at time of application: 50 degrees F.

c. Do not apply if substrate is wet or excessively damp.

2. Installation of base course:

a. Minimum surface temperature at time of placement: 40 degrees F and rising.

3. Installation of surface course:

a. Minimum surface temperature at time of placement: 40 degrees F.

b. Do not apply if base is wet or excessively damp.

### 1.7 SEQUENCING AND SCHEDULING

A. Consult plant personnel responsible for scheduling plant mix production. Establish dates on which the approved job mix will be available for transport to project site.

B. Schedule paving operations and related work to coincide with plant production schedule for approved mix.

C. Schedule delivery of asphalt concrete materials so that spreading, rolling, and finishing of all the mix prepared for one day's run can be completed during daylight hours.

### 1.8 WARRANTY

A. Submit a written warranty signed by the contractor and the paving installer, guaranteeing to correct failures in paving which occur within the specified warranty period, without reducing or otherwise limiting any other rights to correction which the owner may have under the contract documents. Failures are defined to include faulty workmanship or materials.

1. Warranty period: 2 years from date of substantial completion.



## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Provide materials approved by governing authorities for use indicated and complying with requirements of contract documents.
- B. For each type of paving material or mix required, obtain all materials from a single source.
- C. Asphalt Cement (Viscosity-Graded): ASTM D 3381 or AASHTO M 226.
- D. Asphalt Cement (Penetration-Graded): ASTM D 946 or AASHTO M 20.
- E. Coarse Aggregate: ASTM D 692.
- F. Fine Aggregate: ASTM D 1073.
- G. Mineral Filler: ASTM D 242 or AASHTO M 17 limestone dust, Portland cement, or other suitable material.
- H. Prime Coat: Cutback asphalt (ASTM D 2027): MC-30 or MC-70.
- I. Tack Coat: Emulsified asphalt (ASTM D 977 or AASHTO M 140) or cationic emulsified asphalt (ASTM D 2397 or AASHTO M 208), of suitable type, grade, and consistency for application indicated.
- J. Pavement-Marking Paint: Chlorinated rubber-alkyd paint (FS TT-P-115, Type III); factory-mixed, quick-drying, and non-bleeding.
  - 1. Colors: White; yellow, blue for handicapped spaces.

### 2.2 MIXES

- A. Provide hot-laid asphalt concrete plant mixes approved by authorities having jurisdiction, and as follows:
  - 1. Mix must have a proven history of satisfactory performance in the general geographical area where project is located.
  - 2. Minimum compositional requirements, grading band limits, and tolerances allowed per single test shall be in accordance with ASTM D 3515 for the following:
    - a. Mix designation: Type 1 in accordance with "NYSDOT Standard Specifications"
      - 1. Application: Base course.
    - b. Mix designation: Type 6F is in accordance with "NYSDOT Standard Specifications".
      - 1. Application: Surface course.
  - 3. Minimum Marshall test criteria determined by procedures outlined in Asphalt Institute MS-2 shall be as follows:
    - a. Compaction, number of blows each end of specimen: 50.
    - b. Stability: 5338 newtons (1200 pounds) minimum.
    - c. Flow, 0.25 millimeter (0.01 inch):
      - 1. Minimum: 8.
      - 2. Maximum: 16.
    - d. Percent air voids:
      - 1. Minimum: 3.
      - 2. Maximum: 5.
    - e. Voids in mineral aggregate (VMA): Comply with minimum VMA percent for nominal maximum particle size, established in Asphalt Institute MS-2.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Comply with cross sections, elevations, and grades indicated on the drawings.
- B. Prepare and install pavement structures in accordance with practices recommended in the "Asphalt Paving Manual"; Publication MS-8; Asphalt Institute, except to the extent that such practices are superseded by specific requirements of this section.

### 3.2 EXAMINATION

- A. Verification of Subbase Conditions:
  - 1. Verify that subbase is dry and in suitable condition to support paving and imposed loads.
  - 2. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas which are unstable or which require further compaction.
  - 3. Notify engineer in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.
  - 4. Commencement of paving work shall constitute acceptance of subbase conditions.

### 3.3 PREPARATION

- A. General: Immediately before placing asphalt concrete mix, remove all loose or deleterious material from surface over which pavement will be placed. Ensure that subbase is properly prepared to receive paving.
  - 1. Aggregate subbase:
    - a. Sweep loose granular particles from surface of aggregate course. Do not dislodge or disturb in any way the aggregate embedded in compacted surface of subbase course.
- B. General Surface Applications to Prepared Subbase:
  - 1. Prime coat application over aggregate subbase:
    - a. Schedule prime coat application sufficiently in advance of placement of paving mix to allow thorough setting.
    - b. Apply prime coat at a rate of 0.20 to 0.50 gallon per square yard. Do not flood surface, but apply sufficient quantity to penetrate and seal.
    - c. Cure for period required to allow adequate penetration, as well as evaporation of volatiles.
    - d. Take suitable precautions to protect coated subbase from damage until it is in proper condition to receive paving.

### 3.4 INSTALLATION

- A. Techniques:
  - 1. Placing the mix:
    - a. Spread mix at minimum temperature of 225 degrees F.
    - b. Place asphalt concrete mix on prepared surface and strike off. Place inaccessible and small areas using hand tools.
      - 1. Check mat frequently during placement, to verify correct thickness.
    - c. Before rolling operations begin, check surface using template and straightedge, and correct irregularities.
    - d. Width of paving strips:
      - 1. Minimum placement width of paving strips, unless otherwise approved: 12 feet.

2. Roll first paving strip after placement. Place subsequent paving strips, extending rolling operation to overlap preceding strips.
  - e. Coursing requirements:
    1. Lifts:
      - a. Base course:
        1. Place plant-mixed asphalt concrete base course in single lift.
        2. Staged construction: Do not place top surface cours until remaining construction is completed.
      - b. Surface course:
        1. Place plant-mixed asphalt concrete surface course in single lift.
2. Joints:
  - a. General: Construct joints to form continuous bond between adjoining portions of work. Ensure that texture and density of pavement are continuous across the joint. Surface across joint shall form smooth, uninterrupted plane and shall not pond water.
  - b. Joint locations include the following:
    1. Between pavements laid on successive days.
    2. At any point in paving where material already laid has become cold because of delay.
  - c. Clean by brushing, or cut fresh vertical face using power saw if necessary, wherever contact surface of previously constructed pavement has become coated by dust, sand, or other objectionable material.
  - d. Apply thin tack coat on vertical contact surface before beginning placement of new material.
3. Rolling:
  - a. Start rolling operation as soon as hot mix will bear weight of roller and can be compacted without unacceptable displacement of material.
  - b. Complete compaction before mix temperature drops below 185 degrees F.
  - c. Comply with roller manufacturer's recommended rolling speed, but in no case exceed 3 miles per hour.
  - d. Avoid sharp turns and abrupt starts and stops.
  - e. Compact mixture in areas inaccessible to rollers using hot hand tampers or vibrating plate compactors.
  - f. Breakdown rolling:
    1. Use steel-wheeled rollers for breakdown rolling of base course.
    2. Use steel-wheeled rollers for breakdown rolling of surface course.
    3. If grade is not absolutely level, begin breakdown rolling on low side of spread. Progress toward high side.
    4. Execute initial breakdown pass with drive wheel forward toward the direction of paving.
    5. Examine surface immediately after breakdown rolling. Repair as necessary by loosening material in defective areas and filling with hot material.
  - g. Second (intermediate) rolling:
    1. Execute second rolling as soon as possible after breakdown rolling, while mixture is still hot enough to achieve maximum density.
    2. Continue repeating the pattern until mixture has been compacted thoroughly.
  - h. Finish rolling:
    1. Execute finish rolling while mixture is sufficiently warm to allow removal of roller marks.
    2. Continue rolling operation until maximum density is achieved and roller marks are entirely eradicated.
4. Patching:
  - a. Remove paved areas which are contaminated with foreign materials or which are defective in any way. Replace removed material with fresh, hot mix. Compact by rolling until maximum density and smoothness are achieved and there is no

- detectable variation between patch and adjacent paving.
5. Restriction of traffic:
    - a. Upon completion of rolling operations, do not permit vehicular traffic on pavement until it has cooled and hardened sufficiently.
    - b. Erect clearly-visible barricades and take other measures as required to protect pavement.
- B. Interface with Other Products:
1. Pavement marking:
    - a. Do not begin application of pavement-marking paint until engineer has approved marking placement.
      1. Verify proper placement of each color of marking paint.
    - b. Sweep and clean pavement surface thoroughly, immediately before application of marking paint. Pavement shall be dry and in proper condition to receive paint.
    - c. Use mechanical paint applicator to create pavement marks with consistently even edges. Apply 2 coats at paint manufacturer's recommended spreading rates.
- C. Installation Tolerances:
1. Maximum allowable variance of in-place compacted thickness from design thickness -- base course: Plus 1/2 inch, minus zero inches.
  2. Maximum allowable variance of in-place compacted thickness from design thickness -- surface course: Plus 1/4 inch, minus zero inches.
  3. Maximum allowable variance of surface smoothness - base course: Plus or minus 1/4 inch.
    - a. Use 10-foot straightedge moved systematically over entire paved area to determine compliance with surface smoothness tolerance indicated.
  4. Maximum allowable variance of surface smoothness - surface course: Plus or minus 1/8 inch.
    - a. Use 10-foot straightedge moved systematically over entire paved area to determine compliance with surface smoothness tolerance indicated.
  5. Maximum allowable variance of surface smoothness - crowned surfaces: Plus or minus 1/4 inch.
    - a. Place crowned template at right angle to crown and move template systematically along entire length of crown to determine compliance with surface smoothness tolerance indicated.
  6. In-place density: Pavement shall be compacted to at least 96 percent of density obtained by laboratory compaction.

END OF SECTION 321313

## SECTION 321613 - CONCRETE CURBING

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Curb installation

#### 1.02 RELATED SECTIONS

- A. Section 312001 – Earth Moving
- B. Section 321313 – Bituminous Concrete Paving

#### 1.03 REFERENCES

- A. Comply with ACI 301-89 for all work specified as part of this section unless specifically indicated otherwise within the Contract Documents.

#### 1.04 SUBMITTALS

- A. Comply with the requirements of Division 01 – Submittal Procedures and as modified below.
- B. Product Data: Submit manufacturer's name, specifications and installation instructions for each item specified.
- C. Quality Control Submittals
  - 1. Qualifications Certification: Submit written certification or similar documentation signed by the applicable subcontractor, prime contractor and/or manufacturer (where applicable) indicating compliance with the "Qualifications" requirements specified below in the "Quality Assurance" section of this specification.
  - 2. Experience Listing: Submit a list of completed projects using the products proposed for this project, including owner's contact information and telephone number for each project, demonstrating compliance with applicable "Qualifications" requirements specified in the "Quality Assurance" section of this specification.
- D. Closeout Procedures: Comply with the requirements of Division 01.

#### 1.05 QUALITY ASSURANCE

- A. Regulatory Requirements
  - 1. Obtain written permission from applicable agencies prior to the start of construction. Submit one copy of the permit as specified in "Submittals-Quality Control Submittals" above.

#### 1.06 PROJECT CONDITIONS

- A. Field Measurements: Establish and maintain required lines and elevations for grade control.

- B. Existing Conditions: Maintain access for vehicular and pedestrian traffic as required for other construction activity. Provide barricades, warning signals, warning lights and similar items as required.

#### 1.07 SEQUENCING AND SCHEDULING

- A. Proceed with and complete concrete curb construction as rapidly as portions of the site become available, working within seasonal limitations for the work required.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Concrete: Normal weight, air entrained concrete with a minimum compressive strength of 4,500 psi at the end of 28 days. Design air content shall be 6% by volume, with an allowable tolerance of plus or minus 1%. Concrete shall contain a minimum of 6.5 bags of cement per cubic yard. Slump shall be between 2 and 4 inches.
- B. Joint Fillers: Closed Cell Polyurethane Joint Filler: Resilient, compressible, semi-rigid, closed cell isometric polymer foam material, minimum ½" thick similar to Ceramar Joint Filler as manufactured by W.R. Meadows, Inc., Elgin IL.
  - 1. Fiber board or cork joint filler material is NOT acceptable for use in concrete expansion joint work.
- C. Joint Sealants: Two-part non-sag polyurethane sealant. For convenience, details and specifications have been based on the following manufacturers and their products:
  - 1. Vulkem 227 by Mameco International, Inc., Beachwood, OH.
  - 2. Dynatrol II by Pecora Corp, Harleysville, PA.
  - 3. Chem-Calk 500 by Bostik Inc., Middleton MA.
- D. Reinforcing Bars and Dowels: Deformed steel bars, ASTM A 615, Grade 60.

#### 2.02 EQUIPMENT

- A. Forms: Steel of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Bent, twisted, split or defective form materials are not acceptable. Use flexible spring steel forms to form radius bends. Coat forms with non-staining, clear, paraffin base form oil that will not discolor or otherwise deface the surface of concrete.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Installer Verification of Conditions: Examine conditions under which concrete curbs are to be constructed with the materials and components specified in this section. Affected Prime Contractors, the Owner's Representative and the Project Designer shall be notified in writing of any conditions detrimental to the proper and timely installation of the work.
  - 1. When the installer confirms conditions as being acceptable to ensure proper and timely installation of the work and to ensure requirements of applicable warranties or guarantees

can be satisfied, submit written confirmation to the Project Designer. Failure to submit written confirmation and subsequent installation will be assumed to indicate conditions are acceptable to the installer.

### 3.02 PREPARATION

- A. Surface Preparation: Remove all loose material from the compacted sub-base surface immediately before placing concrete. Establish and maintain required lines and grades.

### 3.03 INSTALLATION

#### A. Form Construction

1. Set approved forms true to line and grade, rigidly braced and secured. Cast curb in 30 foot long sections.
2. If curbs will abut existing pavement, locate joints opposite existing pavement joints.
3. Profile of curb to be 18" high by 6" wide with a tooled 1½" radius on the top corner unless specifically detailed otherwise on the Contract Documents.
4. Allow forms to remain in place a minimum of 24 hours after concrete placement.

- B. Joint Filler Installation: Provide joint fillers cut to size between the 30 foot sections, at the start and end of curved sections and where curbs abut existing concrete paving, fixed structures or appurtenances. Protect the top edge of the joint filler during concrete placement with a temporary cap and remove after concrete has been placed.

- C. Reinforcement Placement: Reinforce curbs as indicated on the Contract Drawings. Maintain a minimum 3" cover on all reinforcing bars.

- D. Concrete Placement: Do not place concrete until line and grade of subgrade and forms have been verified. Moisten subgrade as required to a uniform dampened condition at the time concrete is placed. Do not place concrete around structures until these items are brought to the required grade and alignment. Deposit and spread concrete in a continuous operation between joints.

- E. Concrete Consolidation: Consolidate concrete by spading, rodding, forking or using an approved vibrator eliminating all air pockets, stone pockets and honeycombing. Consolidate with care to prevent dislocation of dowels and joints.

- F. Remove forms and rub exposed face of curb to a smooth rubbed finish. Plastering is not permitted.

- G. Control Joints: Saw cut control joints at 15' O.C.

- H. Concrete Curing: Cover and cure newly poured concrete curbs for a minimum of seven days in accordance with ACI 301.

- I. Joint Sealant Installation: Remove temporary joint filler cap and install joint sealant per the manufacturer's recommendations.

### 3.04 ADJUSTING AND CLEANING

- A. Repairs and Protection of Concrete Curbing

1. Repair or replace broken or defective concrete curbing as directed by the Project Designer.
2. Protect concrete curbing from damage until acceptance of the curb construction.

END OF SECTION 321613



## SECTION 321614 - CONCRETE SITE WORK

### PART 1 - GENERAL

1.01 General: All concrete work (material & construction procedure) shall be in accordance with ACI Standard 318-83 (R-86). Contractor shall perform all concrete work above and below grade as indicated on the drawings and as required.

Concrete shall be capable of developing minimum compressive strength of 4,000 psi at 28 days.

Add air entraining agency maximum 5% by volume to exposed concrete mix (ASTM C 260).

This work shall include any items for the construction of the retaining wall, sidewalk, and concrete curb.

1.02 Quality Assurance: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:

1. ACI 301 "Specifications for Structural Concrete for Buildings".
2. ACI 318 "Building Code Requirements for Reinforced Concrete".
3. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".

Materials and installed work may require testing and retesting, as directed by Architect, at anytime during progress of work. Allow free access to materials stockpiles and facilities. Tests, including retesting of rejected materials and installed work, shall be done at Contractor's expense.

#### 1.03 Form Materials:

1. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct form work for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. . Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

Use overlaid plywood complying with U.S. Product Standard "A-C or High Density Overlaid Concrete Form", Class 1.

2. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
3. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

#### 1.04 Concrete Materials:

Portland Cement: ANSI/ASTM C 150, Type I. Use one brand of cement throughout project.

Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.

Water: Drinkable.

#### 1.05 Related Materials:

Waterstops: Provide flat, dumbbell type or center bulb type waterstops at construction joints and other joints as shown. Size to suit joints.

Rubber Waterstops: Corps of Engineers CRD-C 513.

Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

Waterproof paper.  
Polyethylene film.  
Polyethylene-coated burlap.

1.06 Proportioning and Design of Mixes: Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.

Submit written reports to Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect.

Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules:

4,000 psi 28-day compressive strength; W/C ratio, 0.44 maximum (non- air-entrained), 0.35 maximum (air-entrained).

Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

Ramps, slabs, and sloping surfaces: Not more than 3".

Reinforced foundation systems: Not less than 1-1/2" & not more than 3".

Other concrete: Not more than 4".

#### 1.07 Concrete Mixes:

Job-Site Mixing: Mix materials for concrete in appropriate drum type batch machine mixer. For mixers of one cu. yd., or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cu. yd., increase minimum 1-1/2. minutes of mixing time by 15 seconds for each additional cu. yd., or fraction thereof.

Ready-Mix Concrete: Comply with requirements of ANSI/ASTM C 94, and as herein specified.

During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ANSI/ASTM C 94 may be required.

When air temperature is between 85° F (30°C) and 90°F (32°C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°F (32°C), reduce mixing and delivery time to 60 minutes.

Concrete Coloring Systems: Concrete coloring systems shall be Chromix admixtures; L.M. Scofield Company for main areas as shown on the drawings and Lithotex Colorstone; L.M. Scofield Company for accent areas as shown on the drawings. Admixtures shall conform to ASTM C 494, AASHTO M 194 and CRD C 87, and ASTM C 979 as coloring agents.

1.08 Forms: Design, erect, support, brace and maintain form work to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct form work so concrete members and structures are of correct size, shape, alignment, elevation and position.

Design form work to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, regrets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, regrets, recesses, and the like, to prevent swelling and for easy removal.

Provide temporary openings where interior area of form work is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

Unless otherwise indicated, provide ties so portion remaining within concrete after removal is at least 1-1/2" inside concrete.

Provisions for Other Trades: Provide openings in concrete form work to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

1.9 Joints:

Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Architect.

Provide keyways at least 1-1/2" deep in construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.

Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.

Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions.

Construct isolation joints in slabs-on-ground at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated.

Form contraction joints by inserting pre-molded hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. After concrete has cured, remove inserts and clean groove of loose debris.

Contraction joints may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.

1.10 Preparation of Form Surfaces: Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.

Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel form work is not acceptable.

1.11 Concrete Placement: Before placing concrete, inspect and complete form work installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

Comply with ACI 304 and as herein specified.

Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning flashing operations.

Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

When air temperature has fallen to or is expected to fall below 40°F (4°C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F (10°C), and not more than 80°F (27°C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

Wet forms thoroughly before placing concrete.

Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

1.12 Finish of Formed Surfaces: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise imparted by form indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height -rubbed down or chipped off.

At tops of walls, horizontal offsets surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

1.13 Monolithic Slab Finishes: Reserved

1.14 Concrete Curing & Protection: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

Curing Methods: Perform curing of concrete by. moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof, as herein specified.

Provide moisture curing by following methods:

1. Keep concrete surface continuously wet by covering with water.
2. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

Provide moisture-cover curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

Cure unformed surfaces, such as slabs and other flat surfaces by application of appropriate curing compound.

1.15 Removal of Forms: Form work not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50° F. (10°C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

1.16 Re-Use of Forms: Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new form work.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove f-ins and laitance, and tighten forms to close joints. Align and secure joint- to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

1.17 Miscellaneous Concrete Items: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

Grout base plates and foundations as indicated, using specified non-shrink grout. Use nonmetallic grout for exposed conditions, unless otherwise indicated.

1.18 Concrete Surface Repairs:

Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms.

Cut out honeycomb, rock pockets, voids over ¼" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, stains, air bubbles, honeycomb, rock pockets; f-ins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out from tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified.

Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.

Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01' wide or -which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.

Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least ¾" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2 ½ parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.

Repair methods not specified above may be used, subject to acceptance of Architect.

1.19 Quality Control Testing During Construction: Sampling and testing for quality control during placement of concrete may include the following, as directed by Architect.

Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

1. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
2. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure for normal weight concrete; one for each set of compressive strength test specimens.
3. Concrete Temperature: Test hourly when air temperature is 40°F (4°C) and below, and when 80°F (27°C), and above; and each time a set of compression test specimens made.
4. Compression Test Specimen: ASTM C 31; one set of 6 standard cylinders or each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

END OF SECTION 321614



## SECTION 321723 – PAVEMENT MARKINGS

### 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 painted markings applied to asphalt pavement.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include technical data and tested physical and performance properties.

#### 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Standard Specifications of New Jersey Department of Transportation for pavement-marking work.
  - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

#### 1.5 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4.4 deg C) for alkyd materials, and not exceeding 95 deg F (35 deg C).

### PART 2 - PRODUCTS

#### 2.1 PAVEMENT-MARKING PAINT

- A. Pavement-Marking Paint: MPI #32, alkyd traffic-marking paint.
  - 1. Color: As indicated.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.
- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

### 3.2 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Sweep and clean surface to eliminate loose material and dust.
- C. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).
  - 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.

### 3.3 PROTECTING AND CLEANING

- A. Protect pavement markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723

## SECTION 329200 – LAWNS AND GRASSES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes seeding and sodding. Base bid shall be sod. Deduct alternate will include hydro-seeding in lieu of sod.

#### 1.2 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product certificates.
- C. Planting Schedule: Indicating anticipated planting dates.

#### 1.4 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.
- B. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding."

#### 1.6 LAWN MAINTENANCE

- A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Seeded Lawns: 60 days from date of Substantial Completion.
  2. Sodded Lawns: 30 days from date of Substantial Completion.
- B. Mow lawn as soon as top growth is tall enough to cut. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings.

## PART 2 - PRODUCTS

### 2.1 SEED (applied by hydro-seed)

- A. Seed Species: State-certified seed of grass species, as follows:

- |                                     |     |
|-------------------------------------|-----|
| 1. Midnight Star Kentucky Bluegrass | 30% |
| 2. Brilliant Kentucky Bluegrass     | 40% |
| 3. P105 Kentucky Bluegrass          | 40% |

### 2.2 TURFGRASS SOD

- A. Turfgrass Sod: Sod shall be certified to complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.
- B. Turfgrass Species: Sod of grass species as follows:
1. Sod shall be 100% Tuckahoe Bluegrass Sod (or approved equal). A certified Sod Certificate must be presented to the Engineer/Owner upon delivery of the sod. If sod certificate does not meet specifications, it will be the Contractor's responsibility to install correct sod. The contractor will absorb all costs if sod and certificate do not meet specifications.

### 2.3 PLANTING MATERIALS

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones **1 inch** or larger in any dimension and other extraneous materials harmful to plant growth.
1. Topsoil Source: Reuse surface soil stockpiled on-site and supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Verify suitability of stockpiled surface soil to produce topsoil.
  2. Topsoil Source: Amend existing in-place surface soil to produce topsoil. Verify suitability of surface soil to produce topsoil. Surface soil may be supplemented with imported or manufactured topsoil from off-site sources.
- B. Inorganic Soil Amendments:
1. Lime: ASTM C 602, Class T or O, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.

2. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 (3.35-mm) sieve and a maximum 10 percent passing through No. 40 (0.425-mm) sieve.
3. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
4. Aluminum Sulfate: Commercial grade, unadulterated.

C. Organic Soil Amendments

1. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8.
2. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with pH range of 3.4 to 4.8.
3. Peat: Finely divided or granular texture, with pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having water-absorbing capacity of 1100 to 2000 percent.
4. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

D. Fertilizer:

1. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 3 percent nitrogen and 15 percent phosphoric acid.
2. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
3. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
  - a. Composition: 10-20-10

E. Mulches:

1. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
2. Peat Mulch: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with pH range of 3.4 to 4.8.
3. Peat Mulch: Finely divided or granular texture, with pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having water-absorbing capacity of 1100 to 2000 percent.
4. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8.

## PART 3 - EXECUTION

### 3.1 LAWN PREPARATION

- A. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
  1. Apply superphosphate fertilizer directly to subgrade before loosening.

2. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
  3. Spread topsoil mix to a depth of **4 inches** but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
- B. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:
1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
  2. Loosen surface soil to a depth of at least of **6 inches**. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top **4 inches** of soil. Till soil to a homogeneous mixture of fine texture.
  3. Remove stones larger than **1 inch** in any dimension and sticks, roots, trash, and other extraneous matter.
  4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus **1/2 inch** of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.
- D. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- E. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

### 3.2 SEEDING

- A. Sow seed at the rate of **2 lb/1000 sq. ft.**
- B. Rake seed lightly into top **1/8 inch** of topsoil, roll lightly, and water with fine spray.
- C. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of **2 tons/acre** to form a continuous blanket **1-1/2 inches** in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.

### 3.3 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
1. Lay sod across angle of slopes exceeding 1:3.
  2. Anchor sod on slopes exceeding 1:6 with wood pegs spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

- C. Saturate sod with fine water spray within two hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.

#### 3.4 SATISFACTORY LAWNS

- A. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
- B. Satisfactory Sodded Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.
- C. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

END OF SECTION 329200





## SECTION 329300 – LANDSCAPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Fine grading of areas.
  - 2. Preparation of soil prior to planting.
  - 3. New topsoil.
  - 4. Planting of trees and shrubs indicated on the drawings and including the following:
    - a. Coniferous evergreens.
  - 5. Furnishing and installation of miscellaneous landscaping materials.
  - 6. Initial maintenance of trees.
- B. Related Sections:
  - 1. Earthwork: Elsewhere in Division 31.
  - 2. Site Improvements: Elsewhere in Division 32.
  - 3. Utilities: Elsewhere in Division 33.

#### 1.2 REFERENCES

- A. ANSI Z60.1-1990 -- American Standard for Nursery Stock; 1990.
- B. ASTM D 2980-71(90) -- Standard Test Method for Volume Weights, Water-Holding Capacity, and Air Capacity of Water-Saturated Peat Materials; 1971 (Reapproved 1990).
- C. COE CW-02215 -- Civil Works Construction Guide Specification for Geotextiles Used as Filters; Corps of Engineers; March 1986.
- D. Rules for Testing Seeds; Association of Official Seed Analysts; 1991.

#### 1.3 SUBMITTALS

- A. Certificates of Inspection: Certified product analysis and any certificates required by law to accompany shipments.
- B. Topsoil: Submit soil analysis report.
  - 1. Location of proposed source and proposed stripping depth.
  - 2. Report of detailed soil analysis: Show percentage of each constituent, pH, and other pertinent soil characteristics. Include recommendations of quantity of each soil amendment and fertilizer required to achieve optimum soil conditions.
- C. Planting Schedule: Indicate beginning and ending dates of planting for each material.
- D. Maintenance Instructions: Written instructions for the owner's maintenance of landscaping. Include initial maintenance recommendations, 12 month, and long term recommendations. Submit prior to acceptance of landscaping.

#### 1.4 QUALITY ASSURANCE

- A. General: Comply with government regulations applicable to landscaping.
- B. Employ qualified, experienced landscape personnel.
- C. No substitutions permitted of plant materials. Provide the materials indicated.
- D. Provide plant materials complying with ANSI Z60.1.
- E. Inspection:
  - 1. The architect retains the right to inspect planting materials at any time for compliance with the contract documents including but not limited to latent defects and lack of protection or maintenance and to reject defective material.
    - a. Immediately dispose of rejected materials off the site.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver in original unopened containers displaying weight, guaranteed chemical analysis, and manufacturer's name or furnish in bulk with appropriate certificates. Protect from deterioration.
- B. Ground Cover and Plants: Schedule delivery to avoid storage on site. If planting does not occur on same day as delivery, store in a location protected from sun and weather.
  - 1. Do not shock trees and shrubs by pruning before delivery.
  - 2. Cover to protect stock during transport.
  - 3. Bind stock to protect branches, bark, and overall shape during transport.
  - 4. Balled and burlapped stock: Provide freshly dug stock unless otherwise approved.
  - 5. Do not drop stock. Load and unload with care.
  - 6. Deliver stock only after soil has been prepared. Schedule harvesting and delivery in quantities suitable for immediate planting upon arrival. Plant immediately. If planting cannot be accomplished immediately, provide shade, protect from wind, protect balls or roots from drying by covering at all times with moist saw dust, wood chips, shredded bark, peat moss, or other similar mulching material.

#### 1.6 PROJECT CONDITIONS

- A. Schedule and coordinate with work of other sections and local seasons.
  - 1. Utilities: Locate and avoid damage to underground utilities.
- B. Excavation: Notify the architect of any unforeseen conditions affecting plant growth (buried debris, etc.).
- C. Planting Time:
  - 1. For each type of landscape work required, place or install materials during normal planting seasons of the project locale.
    - a. Flowering trees and shrubs: Plant during the spring planting season unless otherwise approved.
- D. Sequencing: Establish final grades, then plant trees and lawns unless otherwise approved. Protect earlier plantings from later planting operations and repair any resulting damage.

## 1.7 WARRANTIES

- A. General: Warranties shall be in addition to, and not a limitation of, other rights the owner may have against the contractor under the contract documents.
- B. Trees: Warrant trees through specified maintenance period and until final acceptance.
- C. Replace unsatisfactory landscape materials (those dead or lacking vigor) with healthy, vigorous materials. Plant only during next occurring specified planting season.
  - 1. At the direction of the architect, either replace materials in borderline condition or extend the warranty covering such materials for one full growing season.
    - a. Another inspection will be conducted at the end of the extended warranty period, if any, to determine acceptance or rejection.
  - 2. Only one replacement (per tree, shrub, plant, etc.) will be required at the end of the warranty period, except for losses or replacements due to failure to comply with specified requirements.

## 1.8 MAINTENANCE

- A. Trees: Maintain trees from immediately after planting until the latest of: the period required to establish acceptable healthy plant growth, substantial completion of the project, or 60 days after date of substantial completion of planting.
  - 1. Provide all maintenance necessary to achieve healthy plant growth.
    - a. Water regularly and on a timely basis.
    - b. Remove weeds, replace mulch, and restore eroded watering basins around trunks if needed.
  - 2. Adjust stakes and guys to provide proper support and replant trees and shrubs to vertical position if necessary.
  - 3. Renew wrappings if damaged.
  - 4. Apply insecticides or fungicides if necessary to prevent or correct insect infestation and disease.

## PART 2 - PRODUCTS

### 2.1 TOPSOIL

- A. Topsoil at Site: Verify suitability and quantity of topsoil stockpiled at site. If sufficient quantities of suitable topsoil are not available at site, provide topsoil from approved off site sources.
- B. Topsoil: Fertile agricultural soil, typical for locality, capable of sustaining vigorous plant growth and taken from a drained site; free of subsoil, rocks larger than 2 inches in diameter, clay, toxic matter, plants, weeds, and roots.

### 2.2 TREES

- A. Provide nursery or plantation grown stock unless specifically indicated otherwise.
  - 1. General: Well-branched and well-formed, sound, vigorous, healthy, and free from disease, sun-scald, windburn, abrasion, and harmful insects or insect eggs. Healthy, normal and unbroken root systems.

2. Deciduous trees and shrubs: Symmetrically developed, of uniform habit of growth, with straight boles or stems, and free from objectionable disfigurements.
  3. Coniferous evergreen trees and shrubs: Well-developed symmetrical tops with typical spread of branches for each particular species or variety.
  4. Provide stock complying in all respects with ANSI Z60.1 and in sizes indicated, measured in accordance with ANSI Z60.1. Larger sizes with larger roots and root containment may be furnished if approved by the architect.
    - a. Do not spread or compress branches when measuring. Measure main body of branches; do not measure extreme tip to tips of single branches.
    - b. Pruning to size is not acceptable.
    - c. Up to 4 inches caliper, measure caliper at 6 inches above ground. Measure larger calipers at 12 inches above ground.
- B. Shade and Flowering Trees: Balled and burlapped (B & B).
1. Equally sized container grown stock will also be accepted.
- C. Deciduous Shrubs: Balled and burlapped (B & B).
1. Equally sized container-grown stock will also be accepted.
- D. Coniferous Evergreens: Balled and burlapped (B & B).
- E. Broadleaf Evergreens: Balled and burlapped (B & B).

## 2.3 MISCELLANEOUS LANDSCAPE MATERIALS

- A. Gravel: Clean, durable, graded crushed rock.
1. Size: 1-1/2 inches maximum, 3/4 inch minimum.
- B. Decorative Mulch: Free of deleterious materials, suitable for top dressing of plantings, and consisting of the following:
1. Ground or shredded bark.
- C. Filter Fabric: Nonwoven polyester or polypropylene fabric having an equivalent opening size (EOS) of 80 to 120 in accordance with COE CW-02215.
- D. Anti-Erosion Mulch: Salt hay, sudan-grass hay, broomsedge hay, or threshed straw of oats, wheat, rye, barley, or rice that is clean and free of seeds, noxious weeds, mold or other objectionable material.
- E. Staking and Guying Materials:
1. Stakes: Pressure-preservative treated lumber of sizes indicated; sound, straight, and free of splits and knots larger than 1/4 of the least nominal dimension of the piece. Sharpen end and chamfer sides of driven end to prevent splitting from off-center hammer strikes.
  2. Wire: Galvanized mild steel wire, minimum 12 gage; provide double strands.
  3. Hose: Rubber or plastic garden hose.
  4. Turnbuckles: Aluminum or galvanized steel.
- F. Tree Wrap Tape: Nurseryman's standard protective tape.

## 2.4 PLANTING SOIL

- A. Provide planting soil mix consisting of topsoil and amendments as recommended by soils analysis laboratory report.

- B. Mixing: Mix topsoil and amendments thoroughly to provide uniform mixture, using drum-type mechanical mixer, powered rotary tiller, or other means acceptable to the architect.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Layout: Lay out planting locations, mark with stakes, adjust locations if requested, and obtain the architect's approval of locations before proceeding.
- B. Preparation of Planting Soil:
  - 1. Before mixing in drum-type mixer or during tillage operation, clean topsoil of sticks, stones, clay lumps, vegetable matter, and other objectionable objects.
  - 2. Mix topsoil, soil amendments, and fertilizers at the specified rates to achieve a uniform mixture.
  - 3. Pit and trench type backfill: Mix planting soil and stockpile at site, ready for use as backfill.
  - 4. Planting beds: Either mix planting soil before placing or uniformly spread fertilizer and soil amendments on surface of in-place topsoil and till thoroughly before planting.
  - 5. Lawns: Either mix planting soil before placing or uniformly spread fertilizer and soil amendments on surface of in-place topsoil and till thoroughly before planting.
- C. Preparation for Planting Lawns:
  - 1. Prepare only those areas that will be planted presently.
  - 2. Preparation of stripped areas: Till subgrade to a depth of at least 6 inches.
    - a. Place topsoil in two approximately equal lifts, working first lift into subgrade before placing second lift.
    - b. Spread second lift to comply with finished lines, grades, and elevations required after allowing for settlement.
  - 3. Fine-grade, roll, rake, and drag lawn areas cutting down high spots and filling low spots, leaving a smooth, even surface of fine-textured soil complying with required grades.
  - 4. If dry, water full depth of topsoil thoroughly but not excessively and allow surface moisture to dry before planting.
  - 5. Just before planting, correct any lawn areas that have been eroded, rutted or settled.
- D. Preparation of Planting Beds:
  - 1. Excavate beds to depth necessary to receive 8 inches of planting soil. Dispose of excavated soil off site.
- E. Planters:
  - 1. Spread 4-inch-thick layer of gravel in planter.
  - 2. Install layer of filter fabric, lapping ends and edges a minimum of 3 inches. Turn edges up sides of planters a minimum of 2 inches and secure with adhesive tape, fasteners, or both, as applicable.
  - 3. Place planting soil in lifts not to exceed 6 inches in thickness; compact lightly.
    - a. Fill planters to within 1-1/2 inches of top of planter, allowing for settlement of planting soil.
- F. Excavation for Trees and Shrubs:
  - 1. Pits, beds, and trenches: Excavate with sides vertical, bottom flat but with high center for drainage. Deglaze sides and loosen bottom.
  - 2. Minimum dimensions, individual pits:
    - a. Diameter:

1. Ball or root spreads up to 2 feet: Twice root spread.
2. Ball or root spreads 2 to 4 feet: Two feet greater than root spread.
3. Ball or root spreads over 4 feet: 1-1/2 times root spread.
- b. Depth: To allow 9 inches of compacted planting soil beneath roots or ball and to set collar 1 inch below finish grade.
3. Remove all excavated subsoil from the site and dispose of properly. Do not backfill excavation with subsoil.
4. Check permeability of soil and pre-moisten soil by filling excavation with water. If excavation does not percolate within 2 hours, inform the architect and obtain his instructions before planting.

### 3.2 PLANTING TREES AND SHRUBS

- A. Setting Layer: Place and compact a layer of planting soil, of thickness indicated, in bottom of excavation.
- B. Balled and Burlapped Stock: Set plants in excavation with top of ball to match adjacent finished grade. Add soil as required under ball to achieve plumb.
  1. Remove burlap from top and sides of ball; retain burlap on bottom of ball.
  2. Place backfill in 2- to 3-inch-thick layers. Work each layer by hand to compact backfill and eliminate voids. Maintain plumb during backfilling.
  3. When backfilling is approximately 2/3 complete, saturate backfill with water and repeat until no more can be absorbed.
  4. Place and compact remainder of backfill and water again.
- C. Container-Grown Plants: Place and backfill as specified for balled and burlapped stock, and as follows:
  1. Immediately before placing, remove bottom of container.
    - a. Cans: Cut two sides from bottom of can to within 1 inch of top, using approved can cutter.
  2. Set and plumb plants. Place initial backfill and remove sides of container, taking care to avoid damage to root system.
- D. Form watering basin around trunk with backfill holding at least 2-1/2 gallons for shrubs and 5 gallons for trees. Apply moisture retaining mulch.
- E. Pruning: Remove dead or broken branches. Prune to retain typical growth habit of plants with as much height and spread as practicable. Make cuts with sharp instruments and flush with trunk or adjacent branch. Do not remove leaders from trees.

### 3.3 STAKING AND GUYING OF TREES

- A. Protection of Tree Trunks:
  1. Inspect and, if necessary, treat trunks for physical damage or insect infestation.
  2. Wrap trunks of trees of 2 inches and greater caliper using wrapping tape. Wrap from base to first branches.
- B. Guy and stake trees the same day as planting.
- C. Refer to drawings and schedules for guying and staking requirements.

### 3.4 PLANTING GROUND COVER AND SMALL PLANTS

- A. Individual Plants:

1. Space plants as indicated on drawings or in schedule.
  2. Open holes sized to accommodate roots, place plants at proper elevation, and backfill with planting soil, working carefully to avoid damage to roots and to leave no voids. Build up a small water basin of planting soil around each plant.
- B. Immediately after planting water well. Do not wash soil onto crowns of plants.
- C. Protection: Provide daily watering, straw mulch, or both, as necessary to protect plants from sun and wind until plants are fully recovered from transplanting shock.
1. Remove straw mulch when plants have attained healthy growth.
- D. Weed Killer: At the contractor's option, apply a pre-emergence weed killer; replace plants adversely affected.

### 3.5 INSTALLATION OF MISCELLANEOUS MATERIALS

- A. Decorative Mulch:
1. Apply 4-inch-thick layer of mulch in the following areas:
    - a. Individual planting pits.
    - b. Planting beds.
  2. Work mulch into top of planting soil backfill; finish level with adjacent grade.

END OF SECTION 329300





## SECTION 330500 – COMMON WORK RESULTS FOR UTILITIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping joining materials.
  - 2. Transition fittings.
  - 3. Sleeves.
  - 4. Grout.
  - 5. Flowable fill.
  - 6. Piped utility demolition.
  - 7. Piping system common requirements.
  - 8. Equipment installation common requirements.

#### 1.3 DEFINITIONS

- A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
- B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- C. PVC: Polyvinyl chloride plastic.

#### 1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

## 1.6 COORDINATION

- A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

## PART 2 - PRODUCTS

### 2.1 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Solvent Cements for Joining Plastic Piping:
  - 1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

### 2.2 TRANSITION FITTINGS

- A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
- B. AWWA Transition Couplings NPS 2 (DN 50) and Larger:
  - 1. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.
- C. Plastic-to-Metal Transition Fittings:
  - 1. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.
- D. Plastic-to-Metal Transition Unions:
  - 1. Description: MSS SP-107, PVC four-part union. Include brass threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

- E. Flexible Transition Couplings for Underground Non-pressure Drainage Piping:
  - 1. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

## 2.3 SLEEVES

- A. Mechanical sleeve seals for pipe penetrations are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

## 2.4 GROUT

- A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post hardening, volume adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## 2.5 FLOWABLE FILL

- A. Description: Low-strength-concrete, flowable-slurry mix.
  - 1. Cement: ASTM C 150, Type I, portland.
  - 2. Density: 115- to 145-lb/cu. ft. (1840- to 2325-kg/cu. m).
  - 3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
  - 4. Aggregates: ASTM C 33, natural sand, fine.
  - 5. Admixture: ASTM C 618, fly-ash mineral.
  - 6. Water: Comply with ASTM C 94/C 94M.
  - 7. Strength: 100 to 200 psig (690 to 1380 kPa) at 28 days.

# PART 3 - EXECUTION

## 3.1 PIPED UTILITY DEMOLITION

- A. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
- B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### 3.2 PIPING INSTALLATION

- A. Install piping according to the following requirements and utilities Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
    - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
- J. Verify final equipment locations for roughing-in.
- K. Refer to equipment specifications in other Sections for roughing-in requirements.

### 3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- F. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.
- G. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
  - 3. PVC Non-pressure Piping: Join according to ASTM D 2855.

### 3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### 3.5 EQUIPMENT INSTALLATION

- A. Install equipment level and plumb, unless otherwise indicated.
- B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.
- C. Install equipment to allow right of way to piping systems installed at required slope.

### 3.6 GROUTING

- A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.

- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 330500

## SECTION 331116 - SITE WATER UTILITY DISTRIBUTION PIPING

### PART 1 - GENERAL

#### 1.01 DUCTILE IRON PIPE

##### A. DESCRIPTION

1. The work under this item shall include the installation of ductile iron pipe and appurtenances as shown on the contract drawings and as specified herein.

##### B. QUALITY ASSURANCE

1. All work shall be performed in accordance with the latest editions of the standards of the American Water Works Association and the American National Standards Institute.
2. Referenced Standards:
  - a. ANSI/AWWA C111/A21.11-85; Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
  - b. ANSI/AWWA C104/A21.4-85; Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
  - c. ANSI/AWWA C151/A21.51-86; Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand Lined Molds, for Water or Other Liquids.
  - d. ANSI/AWWA C600-87; Installation of Ductile-Iron Water Mains and their Appurtenances.

##### C. SUBMITTALS

1. Test of pipe and fittings shall be made by the pipe manufacturer in accordance with ASTM Standards. Certified copies of the tests made by the manufacturer or by a competent commercial laboratory approved by the Engineer shall be submitted to the Engineer prior to the first shipment of pipe.

##### D. MATERIALS

1. Ductile Iron Pipe
  - a. Ductile iron pipe shall be thickness Class 52 in conformance with ANSI A21.51. The pipe shall be cast utilizing iron conforming to Grade 60-42-10 as required in the above noted ANSI specification. Pipe shall be furnished in nominal eighteen (18') foot to twenty (20') foot laying lengths.
  - b. The lining of the pipe shall consist of cement-mortar of double thickness to the ends of the individual lengths of pipe and shall be in accordance with ANSI A 21.4. A bituminous interior seal coat shall be applied to the cement-mortar lining. The exterior of the pipe shall receive standard coal-tar or asphalt foundry dip unless otherwise directed. The weight, class, and pipe material shall be conspicuously indicated by the manufacturer on the outside of the pipe.
  - c. Joints for ductile iron pipe shall be push on joint, except for hydrant laterals, valves, fittings and bends which shall be mechanical joint.
  - d. Gaskets and lubricants will be as recommended by the pipe manufacturer.
  - e. Finish the ends of the cut lengths of pipe in accordance with the manufacturer's instructions.

##### E. RESPONSIBILITY FOR MATERIAL

1. The Contractor shall be responsible for all material and shall place at his own expense all such materials found defective in manufacture or damaged in handling.

All material shall be carefully examined for defects, and no material shall be installed which is known to be defective. Any defective, damaged, or unsound material, as determined by the Engineer, shall be removed and replaced with sound material at the Contractor's expense. Any materials found defective shall be promptly removed from the site.

2. All materials furnished by the Contractor shall be delivered and distributed at the site by the Contractor. All pipe, fittings, valves, and accessories shall be loaded and unloaded by lifting with hoists or skidding, so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.
3. The pipe and fittings shall be so handled that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a manner satisfactory to the Owner and Engineer.

#### F. DEFECTIVE PIPE AND FITTINGS

1. The Owner and Engineer reserves the right to reject all defective pipe and fittings shipped to the job site or stored on the site. The Engineer shall examine the pipe and fittings and determine if the pipe is damaged prior to installation of the pipe in the trench. All defective pipe or fittings shall be laid aside for final inspection by the Engineer to determine if corrective repairs may be made, or the piece is to be rejected. The Engineer shall determine the extent of the repairs, and the Contractor shall comply in all respects. Defective pipe shall be classified as follows:
  - a. Damage to interior and/or exterior paint seal coats.
  - b. Damage to interior cement-mortar lining.
  - c. Insufficient cement-mortar lining thickness.
  - d. Poor quality interior paint seal coat to the extent that it causes a partial obstruction in the pipe round.
  - e. Pipe out of round.
  - f. Damaged pipe barrel area to a point where pipe class thickness is reduced.

#### G. PIPE INSTALLATION

1. The new water main shall be installed in complete sections between valves. Once the entire section is installed, it shall be tested in accordance with Testing and Disinfection. After the new pipe has satisfied the required tests, the services on the existing pipe shall be disconnected and connected to the new pipe as shown on the contract drawings and as specified herein. Upon approval of the testing, disinfection and new connections, the new pipe shall be put into service.
  - a. Cleaning Pipe and Fittings

All lumps, blisters, and excess coating shall be removed from the bell-and-spigot end of each piece of ductile iron pipe and each fitting. The inside of the bell or the coupling grooves and rubber rings shall be thoroughly wiped clean and dry before the pipe is laid.
  - b. Alignment and Grade
    - i. All pipes shall be laid and maintained, as shown on the Contract Drawings, with joints centered, spigots forced home, and all valve and hydrants stems plumb. No deviation shall be made from the required line and grade, except with the approval of the Engineer.
    - ii. Where the proposed route of the pipe is on a curve, the Contractor may, after receiving approval from the Engineer, deflect the pipe at the joints. In no case shall the pipe be deflected more than the maximum permissible deflection recommended by the pipe manufacturer and, in case the curve is too sharp for the allowable deflections, short lengths of pipe may be used upon approval of the Engineer.



- iii. Particular care shall be exercised so that no high points are established where air can accumulate. All water mains shall have a minimum cover of 4'-0", and a maximum cover of 6'-0".
- c. Lower Water Main Material into Trench
  - i. All pipe, fittings and appurtenances shall be carefully lowered into the trench piece by piece by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to water main materials and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.
- d. Laying Pipe
  - i. No pipe shall be laid in wet trench conditions or on a frozen trench bottom or when, in the opinion of the Engineer, trench or weather conditions are unsuitable.
  - ii. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed. During Laying operation, no debris, tools, clothing, or other material shall be placed in the pipe.
  - iii. The pipe shall be supported in its full length on the project line and uniform grade of the trench. A bell-hole shall be dug at each joint, said hole being of sufficient size to insure the proper making up of each joint. After placing a length of pipe in the trench, the spigot end shall be centered in the bell and the pipe forced home.
  - iv. Care shall be exercised when making each joint, and all joints shall be made in accordance with the pipe supplier's specifications and in accordance with the following instructions.
  - v. The cutting of the pipe shall be carried out only with the equipment specifically designed for that purpose. The use of chisels, hand saws, or hand held power saws will not be permitted.
  - vi. Ductile iron pipe shall be laid with the bell ends facing in the direction of laying, unless otherwise shown on the Contract Drawings, or directed by the Engineer.
  - vii. At the end of each day's operation, the Contractor shall properly cover all openings of installed mains, valves and fittings to prevent entry of foreign matter, animals or debris.
- e. Push-on Joints
  - i. All mud, stones, and debris shall be removed from the inside of the bell, from the gasket, and from the spigot end. These parts shall be kept clean throughout assembly of the joint.
  - ii. The entire gasket shall be properly seated and checked by lightly pulling the gasket forward with the fingertips.
  - iii. A minimum amount of lubricant shall be evenly applied to the spigot and with a brush. The spigot end shall be kept clean and lubricated throughout assembly.
  - iv. The spigot end shall be properly centered, force applied using a crowbar or a ratchet jack visible at the face of the bell. Any required deflection shall be made only after the joint assembly has been made.
  - v. If the joint is extremely difficult to assemble, a check shall be made for proper gasket positioning, adequate lubrication and presence of foreign matter at the joint.
  - vi. The edges of "field cut" pipe shall be touched up with a file or grinder so as to remove rough edges and to facilitate assembly.
- f. Mechanical Joints
  - i. With a wire brush, thoroughly clean the bell and spigot end of the pipe of all foreign matter and wash them with soapy water.
  - ii. Slip the gland and gasket over the plain end and seat the spigot end in the bell (the small end of the gasket and the lip on the gland shall face the bell).
  - iii. Push gasket into position with fingers, making sure it is evenly seated.
  - iv. Move gland into position for bolting, insert bolts, and make all nuts finger-tight, keeping the spigot centrally located within the bell.

- v. The following table is used in determining the wrench to be used in tightening the bolts:

Bolt Size, Inches	Length of Wrench, Inches
5/8	8
3/4	10
1	12
1-1/4	14

- vi. When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This is to be done by partially tightening the bottom bolt first, then the top bolt, then the bolts at either side and last, the remaining bolts. Repeat the cycle until all bolts are within the range of the torques listed below:

Bolt Size, Inches	Length of Wrench, Inches
5/8	40 - 60
3/4	60 - 90
1	70 - 100
1-1/4	90 - 120

- vii. If effective sealing is not obtained at the maximum torque indicated above, the joint must be disassembled and reassembled after thorough cleaning. Under no circumstances are bolts to be overstressed.

- viii. Overnight and at other times when pipe laying is not in progress, the open ends of the pipe will be closed by a watertight plug or other means approved by the engineer.

g. Temporary Reaction Backing

- i. Where the water mains must be tested before connections to existing mains can be installed, temporary reaction backing or restraining type plugs shall be installed. Careful attention shall be given to the design and installation of the temporary reaction backing, so that it will resist the test pressure without movement.

h. Pipe Bedding and Backfill

- i. Bedding shall be three-quarter inch (3/4") clean crushed stone as specified herein. Immediately after the pipe is brought to final position, it shall be thoroughly secured and properly bedded, and ample support shall be provided to prevent settlement or disturbances.
- ii. Backfill shall be compacted backfill. As soon as practicable, after the pipe or masonry has been placed and the masonry has acquired a suitable degree of hardness, the backfilling shall begin and shall thereafter be prosecuted expeditiously.

i. Crossing Utility Lines

- i. When crossing over an existing water main, pipe, conduit, or other utility, the new pipe shall be encased in concrete or supported by other means as required or as directed by the Engineer or as shown on the Contract Drawings. In this case, the cover on the pipe may be decreased as required if approved by the Engineer.
- ii. When crossing under an existing pipe, conduit, structure, or other utility, the existing pipe shall be cradled or supported by other means without transmitting the load to the new pipe and the method of construction shall be as required or as directed by the Engineer or as shown on the Contract Drawings.
- iii. In all cases, the pipe shall be properly brought back to the original grade with a smooth transition as directed by the Engineer.
- iv. In all cases of crossing an existing utility, pipe, conduit, or structure, approval of the construction method and the crossing design shall be obtained from the Owner of the utility, pipe, conduit, or structure, if such approval is required. The Contractor shall be responsible for coordination with the appropriate authorities.

j. Separation Between Water Lines and Sewers

- i. Horizontal Separation:

- a. Whenever Possible, water mains shall be laid at least ten feet (10') horizontally from an existing or proposed sewer. Should local conditions prevent a lateral separation of ten feet (10'), a water main may be laid closer than ten feet (10') to a water main if:
  1. It is laid in a separate trench.
  2. The elevation of the top (crown) of the sewer is at least eighteen inches (18") below the bottom (invert) of the water main.
- ii. Vertical Separation:
  - a. Whenever water mains must cross over sewers, the water main shall be laid at such an elevation that the top of the sewer is at least eighteen inches (18") below the bottom of the water main. When the above requirements cannot be met, the water main shall be relocated to provide this separation for a distance of ten feet (10') extending on each side of the sewer. One full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible.
- iii. Unusual Conditions:
  - a. Where conditions prevent the minimum vertical separation above from being maintained, or when it is necessary for the water main to pass under a sewer or drain, the water main shall be laid with mechanical joint pipe, and the pipe should extend on each side of the crossing until the normal distance from the water main to the sewer or drain line is at least ten feet (10'). In making such a crossing, it is preferable to center a length of water main pipe over the sewer to be crossed, so that the joints will be equi-distance from the sewer and as remote therefrom as possible. Where a water main must cross under a sewer, a vertical separation of eighteen inches (18") between the bottom of the sewer and the top of the water main should be maintained, with adequate support for the larger-sized sewer lines to prevent them from settling on and breaking the water main.
  - b. Where conditions prevent the minimum horizontal and vertical separation above from being maintained, the water main shall be laid with mechanical joint pipe until the normal distance from the water main to the sewer is achieved.
- iv. Sewer Manholes:
  - a. New water pipe shall not pass through or come into contact with any part of a sewer manhole.
- k. Connection to Existing Pipes: The Contractor shall advise affected residents twenty-four (24) hours in advance as to the time and duration of the proposed shutdown and all related work.
  - i. The Contractor shall provide the necessary pipe and all else necessary fittings to join the existing system with the pipe and fittings specified herein.
  - ii. The Contractor shall notify the Engineer forty-eight (48) hours in advance as to when a shutdown of the existing water mains is needed to make connections from the new water pipes to the existing water distribution system.
  - iii. All shutdowns of the existing water mains shall be executed by the Township. In general, the shutdown of existing water mains can be made during normal working hours. However, where these shutdowns of existing water mains cannot be made during normal working hours without interruptions to water consumers, the Contractor shall schedule his work so that the shutdowns are made during periods of low demand which may include weekends or night hours. No additional payments shall be made for the costs of installing connections to existing water mains during the low demand periods.
  - iv. Parallel connections between old pipe and new pipe shall be connected to the existing valves with reducers and as manufactured by "Dresser" or approved equal. All joints will be made as specified under this item.
  - v. Perpendicular connections between old pipe and new pipe shall be made with wet taps as specified under Item 5 "Tapping Valves and Sleeves".

- vi. Prior to connecting to existing mains and where shown on the Plans, the Contractor will provide a blow-off branch fitting. The fitting will be installed so the invert of the branch is at the same elevation as the invert of the main. The branch will have a minimum diameter of four inches (4") and will be fitted with a gate valve and sufficient pipe to allow discharge of water at a point that will not cause flooding of the trench. Upon completion of flushing and disinfection, the Contractor will remove the temporary blow-off fitting and will make the connections to the existing water main.
- I. Reconnection of Water Service Lines: The Contractor shall connect proposed service lines to the newly installed water mains. The Contractor shall be responsible for all tapping connections to the new mains. The connection of service connections shall be as indicated on the drawing.

## 1.02 DUCTILE IRON PIPE FITTINGS

### A. DESCRIPTION

1. The Contractor will, under this item, furnish all the materials for and properly connect in place at the locations shown on the Plans or as directed, all ductile iron mechanical joint fittings which are necessary for the proper completion of the work under this contract. Also furnish the necessary pipe, length, restraints, gaskets, jointing material, encasement, and accessories to complete the installation as shown or directed.

### B. MATERIALS

1. Ductile iron fitting shall conform to AWWA C110. All fittings will be mechanical joint conforming to the requirements of "Ductile Iron Fittings, 4" through 54", for Water and Other Liquids", ANSI A21.10. All mechanical joints will conform to the requirements of "Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings", ANSI A 21.11.
2. Where indicated on the plans, the Contractor will furnish a hydrant valve anchoring tee of the specified class.
3. The minimum pressure rating for fittings will be as follows:

	<u>Ductile Iron</u>
24" Diameter and Smaller	350 PSI
30" Diameter and Larger	250 PSI
4. All ductile iron fittings will be lined with Portland cement mortar in accordance with "Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water", ANSI A21.4, and will be double thickness.
5. The outside of all fittings will be coated with coal tar pitch varnish.
6. A bituminous interior seal coat shall be applied to the cement mortar lining.

### C. METHODS OF CONSTRUCTION

1. Perform all work in accordance with the specifications for "Ductile Iron Pipe". Thrust blocking shall be in accordance with "Concrete".

## 1.03 GATE VALVES

### A. DESCRIPTION

1. The work under this item shall include all labor, materials, equipment, and all else necessary for full compliance with the contract drawings, as specified herein and other contract requirements, or as directed by the Engineer for the installation of gate valves and valve boxes.

## B. QUALITY ASSURANCES

1. All work under this contract shall be performed in conformance with the standards of the American Water Works Association and the American National Standards Institute.
2. Referenced Standards:
  - a. ANSI/AWWA C500-86; Gate Valves for Water and Sewerage Systems.
  - b. AWWA C509-80; Resilient Seated Gate Valves 3 through 12 NPS, for Water and Sewerage Systems.

## C. SUBMITTALS

1. Shop drawings at a scale sufficiently large enough to show pertinent aspects of the gate valves and valve boxes shall be submitted along with appropriate manufacturer's literature.

## D. MATERIALS

1. All gate valves shall be mechanical joint type, resilient seated gate valves conforming to AWWA C509-80. The body bonnet, gate and O-ring packing plate will be gray or ductile iron. The valves will be furnished with non-rising stems, O-ring stuffing boxes, resilient valve seats, wedge disc and guides. Valve stems, glands and bushings shall be bronze.
2. Valves shall be furnished with a two (2") inch square operating nut and shall open by turning to the left (counter clockwise) and shall have an arrow indicating the direction of the opening.
3. Valves shall be designated for a working pressure of 200 psi and capable of withstanding a 400 psi test pressure.
4. Each valve shall be equipped with a cast iron, adjustable valve box and cover, with a standard coal tar foundry dip and the word WATER cast in the cover. Valve boxes shall be a minimum of eight (8") inch diameter and shall be an adjustable screw type with box extending from the surface to three (3") inches above the valve bonnet base.
5. Concrete seats for valves shall conform to "Concrete".
6. Valve exteriors shall be painted with asphalt varnish.
7. Hawthorne Water Department standards shall be met. Gate valves shall have mechanical joint fittings with retainer glands.

## E. RESPONSIBILITY FOR MATERIALS

1. All valves shall be loaded and unloaded by lifting with hoists or skidding. Valves shall be so handled that coating will not be damaged.
2. Valves shall be kept drained and stored before installation in a manner protecting them from damage due to freezing of trapped water.

## F. INSTALLATION

1. Valves shall be installed at specified locations with joints centered and valve stems plumb. No deviation shall be made from the required line and grade except with approval of the Engineer.
2. All valves shall be carefully lowered into the trench by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to valves and protective coatings. Under no circumstances shall valves be dropped or dumped into the trench.
3. Valves shall be set and jointed to pipe in the manner heretofore specified for "Ductile Iron Pipe".
4. All valves shall be provided with a valve box. The tops of the valve boxes shall be set neatly to the grade of the surface of finished grade, unless directed otherwise by the Engineer. The valve box shall not transfer shock or stress to the valve and shall be centered and plumb over the valve.

## 1.04 FIRE HYDRANTS

### A. DESCRIPTION

1. The work under this item shall include all labor, material, equipment, and all else necessary for full compliance with the contract drawings, as specified herein, and other contract requirements, or as directed by the Engineer for the installation of new fire hydrants. Fire hydrants shall conform to the standards set by the Hawthorne Water and Fire Departments.

### B. QUALITY ASSURANCES

1. All work and materials shall be in conformance with the latest edition of the standards of the American Water Works Association and the American National Standards Institute.
2. Referenced Standards:
  - a. ANSI/AWWA C502-85; Dry Barrel Fire Hydrants.

### C. SUBMITTALS

1. Shop drawings at a scale sufficiently large enough to show pertinent aspects of the fire hydrants shall be submitted along with appropriate manufacturer's literature.

### D. MATERIALS

1. All fire hydrants will conform to the requirements of Dry Barrel Fire Hydrants, AWWA C502. Hydrants will be designed for a working water pressure of 150 psi and will be provided with a six (6") inch inlet connection of either bell or mechanical joint as shown on the plans. Provide lugs on the inlet connection when required for strapping the hydrant to the main. All hydrants will be furnished with a compression type 4 1/2" main valve, having an opening size as shown on the plans, an automatic positive action drain valve, two section barrel with breakable flange and stem coupling and "O" ring seals. Hydrants will be opened by turning to the left (counter clockwise) and operating, and nozzle cap nuts will conform to those in service in the distribution system where the hydrant is to be installed. The barrel will be of sufficient length for installation in a trench of the required depth.
2. The hydrants will be furnished with one, four and one half (4 1/2") inch steamer and two, two and one half (2 1/2") inch nozzles and be National Standard Thread.
3. Valve stems, main valve seats, operating nuts, and hose and pumper nozzles will be made of bronze.
4. All hydrants will be given two shop coats of a durable weatherproof enamel, above the ground line. The barrel shall be painted yellow and the bonnets painted with white reflective paint.
5. Fire hydrants shall meet Hawthorne Water Department and Hawthorne Fire Department Standards. Fire hydrants shall be Clow Eddies, Model No. F2640.

### E. METHOD OF CONSTRUCTION

1. New hydrants will be located as shown on the drawings or as directed.
2. All hydrants will stand plumb and will have their nozzles parallel with or at right angles to the curb with the pumper nozzle facing the curb. Hydrants having two nozzles 90° apart will be set with each nozzle facing the curb at an angle of 45°. Hydrants will be set to the established grade, with pumper nozzles at least twelve (12") inches above ground, as shown or as directed by the Engineer. Each hydrant will be connected to the main with a six (6") inch ductile iron branch controlled by an independent six (6") inch gate valve, except as otherwise directed.

3. Wherever a hydrant is set in soil that is pervious, drainage will be provided at the base of the hydrant by placing three quarter (3/4") inch crushed stone from the bottom of the trench to at least six (6") inches above the waste opening in the hydrant, and to a distance of one (1') foot around the elbow. No drainage system will be connected to a sewer. Wherever a hydrant is set in clay or other impervious soil, a drainage pit two (2') feet in diameter and three (3') deep will be excavated below each hydrant and filled compactly with three quarter (3/4") inch crushed stone, under and around the elbow of the hydrant and to a level of six (6") inches above the waste opening. No drainage pit will be connected to a sewer. Where directed by the Engineer, the hydrant drain hole will be drilled, tapped, and fitted with a cast iron plug.

## 1.05 TESTING AND DISINFECTING

### A. DESCRIPTION

1. Under this item the contractor will furnish all the materials and equipment for and will properly disinfect and test all the pipes as required and described in these specifications.
2. Contractor shall coordinate with the health department and comply with and assist with all permits, fees, and inspections required.

### B. METHOD

1. The contractor will be required to perform a hydrostatic pressure and leakage test. The work will be done in a manner approved by the engineer. The hydrostatic pressure to be used for the pressure test and for the leakage test will be 200 psi.
2. The contractor will be required to test the entire length of the new water main.
3. The contractor will install temporary air release taps and sampling taps with copper sampling pipe for testing and disinfection as required and directed by the engineer. The contractor will be required to remove the copper sampling pipe and close off the tap at the main after all testing has been completed and when approved by the engineer.

### C. HYDROSTATIC TESTS

1. The contractor will satisfactorily complete a pressure test and leakage test as provided under the specification item for testing and disinfection. The tests will generally conform to the applicable section of "installation of cast iron water mains", AWWA c600, except as modified by these specifications.
2. All pipe will be subjected to a hydrostatic test in the amount as specified herein. The duration of each pressure test will be at least two (2) hours. As it is not the intention of this specification to test any existing piping, temporary closures will be required for sections not closed off by valves.
3. Each section of pipe will be slowly filled with water. The specified test pressure (200 psi), based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, will be applied by means of a pump connection to the pipe in a manner satisfactory to the engineer.
4. The pump, pipe connections, gauges, and all necessary apparatus will be furnished by the contractor. Before applying the specified test pressure, all air will be expelled from the pipe. The contractor will make the necessary taps and install corporation cocks at points of highest elevation before the test is made to expel the air. All exposed pipes, fittings, valves and joints will be carefully examined during the test. Any cracked or defective pipes, fittings or valves discovered as a consequence of this pressure test will be removed and replaced by the contractor with sound material, and the test will be repeated until the results are satisfactory to the engineer.

5. A leakage test will be conducted after the pressure test has been satisfactorily completed. The contractor will furnish the gauge, measuring device, pump, pipe, connections and all other necessary apparatus, and will furnish all necessary labor to conduct the test. The duration of each leakage test will be two (2) hours, and during the test, the main will be subjected to the pressure of 200 psi, as specified herein. Leakage will be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. No pipe installation will be accepted if the leakage is in excess of the amount determined by the following:

$$L = \frac{ND\sqrt{P}}{3700}$$

WHERE:

L - MAXIMUM ALLOWABLE LEAKAGE IN GALLONS PER HOUR

N - EQUAL NUMBER OF JOINTS IN THE LENGTH OF PIPELINE BEING TESTED

D - NOMINAL INSIDE DIAMETER OF THE MAIN, IN INCHES

P - AVERAGE TEST PRESSURE DURING THE LEAKAGE TEST, IN PSIG

6. Should any test of installed pipe disclose leakage greater than that specified above, the contractor at his own expense, will locate and repair the cause until the leakage is within the specified allowance.

#### D. DISINFECTION

1. The contractor shall disinfect the water main in accordance with "disinfecting water mains", AWWA C 651. In some cases, the disinfection will include existing mains because valves will not permit isolating new pipe. Disinfection of the water main will be continued until water samples taken from the pipe are satisfactory to the responsible health official. If required by the water department, separate sets of samples will be taken one (1) week apart to confirm the thoroughness of the disinfection.
2. The contractor will be required to disinfect the newly installed main by using the tablet method and in accordance with AWWA C 651. Following chlorination, the main should be flushed as soon as possible (within twenty-four (24) hours), since prolonged exposure to high concentrations of chlorine might damage the asphaltic seal coating. Prior to disinfecting, the contractor will be required to submit specifically in writing to the engineer, the procedures he intended to use for chlorination and flushing. The specified procedure must be approved by the engineer and owner before proceeding with disinfection.

#### E. BACTERIOLOGICAL TESTS

1. The contractor will furnish the services of a qualified laboratory, approved by the engineer, to determine the bacteriological characteristics of the water. Sample bottles will be used and samples will be collected by the laboratory in the presence of a representative of the owner. Each sample bottle will be clearly marked to show the time and date of sampling, location and number and collector's name. The samples will be delivered immediately to the laboratory for analysis, and if any delays are anticipated, the samples will be refrigerated. Bacteriological sample bottles will contain sodium thiosulfate.
2. The laboratory will submit the results of the analysis in quadruplicate to the engineer. The analyses will be made in accordance with the latest edition of "Standard Methods for Examination of Water and Wastewater", as published by the American Public Health Association, Inc.". The test for coliform shall result in a reading of absence.
3. A minimum of two (2) sampling points will be required on each portion of water main being disinfected up to 1000 feet in length. When the length of water main exceeds 1000 feet, an additional sampling point will be required for each additional 1000 feet or portion thereof.



4. In the event that the initial treatment fails to produce satisfactory water quality, the contractor will flush and disinfect the entire length of water main until the samples on two (2) successive days are satisfactory.

#### 1.06 WATER MAIN EXTENSION PERMIT

##### A. DESCRIPTION

1. Water service permits have been applied for this project. The permit approvals shall be part of this specification and the Contractor shall be responsible for all conditions, requirements, and inspections as stated in the permits.

END OF SECTION 331116



## SECTION 333100 - SANITARY UTILITY SEWERAGE PIPING

### PART 1 - GENERAL

#### 1.01 SANITARY SEWER PIPE

##### A. DESCRIPTION

1. Sanitary sewer pipe shall consist of trench excavation, removal of existing sanitary sewer, bypass pumping as required, furnishing and installing new sanitary sewer as specified, bedding material, backfill and complete restoration of disturbed areas, construction layout of new sanitary sewer with service laterals and follow up internal television inspection.

##### B. MATERIALS FOR PIPES AND FITTINGS

1. Polyvinyl chloride pipe (PVC) and fittings shall conform to the specifications set forth in ASTM D 3034, heavy wall class SDR 35.

##### C. CONNECTIONS

1. Pipe connections to the manhole shall be made with flexible connectors capable of sealing the annular space between the pipe and the manhole opening and of centering the pipe in the opening.
2. Connections to existing pipe, if and where applicable, shall be the fernco flexible pipe coupling appropriate for the material for the existing pipe, fernco couplings, or approved equal.

##### D. CONSTRUCTION REQUIREMENTS FOR SANITARY SEWER REPLACEMENT

1. Open cut excavations shall be made in accordance with the latest provisions of "Subpart P - Excavations, Trenching and Shoring" taken from the Department of Labor, Occupational Safety and Health Administration Construction Safety and Health Regulations as published in the Federal Register and also in accordance with the requirements of subsection 207.04-.07 of the NJDOT Standard Specifications, to protect life, property or the work.
2. The existing sanitary sewer pipe shall be removed as indicated on the plans. Upon removal of the existing pipe, bypass pumping shall be provided except at the direction of the engineer. The contractor shall provide and maintain pumps, piping, hoses, labor, and supervision necessary for the bypass pumping during sanitary sewer replacements.
3. Excavation shall be carried to a depth of six inches below the existing invert grades. Upon this subgrade foundation, a cushion of bedding material as per the construction detail shall be placed and compacted to the grade of the underside of the pipe barrel. The pipe shall then be set to the line and grade and additional bedding material placed to one foot above the pipe.
4. Pipe shall not be laid until the exact locations of utility structures in the vicinity have been determined in the field and the line and grade of the pipes have been approved by the engineer.
5. Supports for existing utilities shall be provided as directed by the engineer.
6. Dewatering methods and equipment shall be adequate to properly dewater the work and shall be subject to the approval of the engineer. In no case will the laying of pipe or the placing of masonry be permitted with water in the excavation nor will completed portions of the work be used as a means of dewatering trenches. Water removed from the work shall be disposed of in an approved manner without damage to adjacent property or other work. All sewage wastes removed from the excavation shall be transported to the municipal sewage treatment plant for disposal.

7. Pipe shall be installed according to the manufacturer's recommendations and the current best practice in the industry.
8. When cutting the pipe is required, the work shall be done with a power saw using a blade appropriate for the material in order to leave a smooth end at a right angle to the axis of the pipe.
9. Prior to the laying of pipe and trench drains, the method to control alignment and grade shall be submitted for approval. The method shall be a laser system or grade board set up to establish a reference grade and alignment control directly above or in the pipe and along the invert of the trench drain.
10. Broken pipe or otherwise damaged pipe shall be replaced.
11. Existing sanitary sewer service laterals must be confirmed by the contractor either during construction or through records obtained by the municipality. All sanitary sewer house connections shall be made flush with the outside edge of the new sanitary sewer pipe and shall be watertight.
12. The contractor should exercise care during construction. If any damage occurs to the existing sanitary pipes, manholes, or service laterals because of the contractor's operations, all damaged material shall be replaced in kind and in a manner satisfactory to the Township at the contractor's expense.
13. All excavations shall be completely backfilled and as great a portion as possible of the excavated material shall be used for backfill. The excavated material to be used for backfill shall be free from stumps, brush, weeds, roots, sod, rubbish, garbage, and other matter that may decay. The excavated material to be used for backfill shall also be free from rock, boulders, frozen materials and clay. It shall be suitable granular material as approved by the engineer. Excavations and backfill shall meet the requirements of Section 2.1 - Earthwork and other applicable sections of this specification.

## 1.02 MANHOLES, SANITARY SEWERS

### A. DESCRIPTION

1. The work of this item shall consist of the construction of sanitary sewer manholes in accordance with the drawings and specifications, at the required locations and to the prescribed lines, grade, and dimensions.

### B. MATERIALS

1. Material shall conform to the requirements specified therefore in Sub-Section 603.02 of the 1989 NJDOT Standard Specifications.

### C. CONSTRUCTION REQUIREMENTS

1. The manhole bottoms shall be Class C concrete. Concrete channels shall be formed in the bottom with a cross section of the depth of one half the sewer diameter, shall slope to the outlet, matching the exact shape of the sewer invert. Channels shall have a minimum slope and shall have a smooth surface.
2. Manhole walls shall be constructed of concrete block and all joints between blocks shall be completely filled with 1:2 cement-sand mortar. Joints shall be made to produce a smooth and uniform surface. The outside surface of each manhole shall be plastered 1/2 inch thick and troweled smooth with cement-sand mortar of the same consistency as above. The outside plastered surface shall be allowed to dry, and then shall be painted with one seal coat of coal tar or asphalt. Manhole walls may be constructed of poured concrete, subject to approval by engineer.
3. Frames shall be well bedded in mortar, making a watertight joint, and shall be adjusted so that the rim is approximately 1/4 inch above finished grade. Cover and frame shall have a shop coat of asphaltic pitch and shall have a field coat of similar paint after the frame is set in final position. Steps shall be provided in the manhole as shown on the drawings.

4. Each manhole shall be constructed absolutely watertight. Manholes that are not watertight will not be accepted. Plastering on top of defective joints to correct leaky conditions will not be permitted.
5. All work shall be done in a workmanlike manner and shall be subject to inspection, requirements and approval of the Municipality.
6. Precast manholes shall be an acceptable alternative.

### 1.03 SANITARY SERVICE CONNECTIONS

#### A. DESCRIPTION

1. The work of this item shall consist of the replacement and construction sanitary sewer laterals from the proposed sanitary sewer pipe to behind the proposed or existing curb, risers, and branch connections. The new lateral shall be of equal or greater size than existing.
2. This item shall include the excavation, removal of existing, bypass pumping as required, furnishings and installing the new sanitary service lateral between the main and a new cleanout, bedding material, backfill and complete restoration of disturbed areas, and a construction layout showing the new service laterals and sanitary sewer main. Also to be included will be a new pipe cleanout, tee, hub, and all miscellaneous items and labor necessary for installation from the main to the new cleanout and to connect the new service lateral from the building to the new cleanout.

#### B. MATERIALS

1. Polyvinyl chloride (PVC) sewer pipe and fittings shall be of 4", 6" or 8" size and shall be manufactured in accordance with ASTM specification D-3034 (SDR-35).
2. Fittings shall be made from virgin PVC compound having a cell classification of 12454-B, 12454-C, or 13343-C, as defined in ASTM D-1784. Different cell classifications having one or more superior properties may be acceptable and shall be submitted to the engineer for approval.
3. Fittings shall be suitable for use with SDR-26 gravity sewer pipe and shall not deflect more than the pipe when loaded and bedded in the same manner.
4. Joints shall be push on type and shall be in accordance with ASTM D-3212. Joints shall be as manufactured by Johns-Manville "ring-tite", certain-teed "fluid-tite" or approved equal.
5. Rubber-ring gaskets shall be molded or extruded and suitable for use with sewage, resistant to oil or solvents, and "in conformance with ASTM D-1869". The compound consisting of either a synthetic or natural rubber basis polymer and shall meet the following physical specifications:
  - a. Durometer Hardness, Points 52-62 Min.
  - b. Ultimate Tensile PST 2000 Min.
  - c. Elongation-Percent 350 Max.
  - d. Tension Set At 250°F 10% Max.
  - e. Modulus At 300% 1200-2300 Psi

#### C. CONSTRUCTION REQUIREMENTS

1. The contractor shall also aid the engineer taking measurements as necessary to permanently locate branch conditions.
2. Building laterals shall be laid coincidental with, or shortly after, the main sewer is installed so that repairs and cleanup are rapidly completed.
3. The pipe shall be laid on continuous upgrade of not less than 1/4" per foot and located where ordered by the engineer.
4. The General Contractor (GC) shall be responsible for the service connection from the main to the building and the connection to the building sanitary waste line.

### 1.04 GENERAL

- A. An NJDEP Treatment Works Approval Permit has been applied for this project. The permit approval shall be part of this specification, and the Contractor shall be responsible for all conditions, requirements, and inspections as stated in the permit and in accordance with N.J.A.C. 7:14A.

END OF SECTION 333100

## SECTION 333900 - SANITARY SEWER STRUCTURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Expansion joints.
  - 2. Encasement for piping.
  - 3. Manholes.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For expansion joints.
- B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- B. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 MANHOLES

- A. Standard Precast Concrete Manholes:
  - 1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
  - 2. Diameter: 48 inches or 72 inches minimum – see drawings.
  - 3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
  - 4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
  - 5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
  - 6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
  - 7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
  - 8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
  - 9. Steps: Individual FRP steps, FRP ladder, or ASTM A 615, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 15-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches.

10. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser, with 4-inch- minimum-width flange and 26-inch- diameter cover (or sizes as indicated on the site plans or construction detail sheets.) Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

## 2.2 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4,000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes. Benches to be swept in 72" diameter manhole.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
  - a. Invert Slope: 2 percent through manhole.
2. Benches: Concrete, sloped to drain into channel.
  - a. Slope: 8 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.



## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section "Earthwork."

### 3.2 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Form continuous concrete channels and benches between inlets and outlet.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.
- E. Install manhole-cover inserts in frame and immediately below cover.

### 3.3 IDENTIFICATION

- A. Materials and their installation are specified in Section "Earthwork." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
  - 1. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

### 3.4 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
  - 1. Submit separate report for each system inspection.
  - 2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  - 4. Re-inspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
  - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
  - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  - 4. Submit separate report for each test.

5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
    - a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water and maintain such pressure without leakage for at least 15 minutes.
    - b. Close openings in system and fill with water.
    - c. Purge air and refill with water.
    - d. Disconnect water supply.
    - e. Test and inspect joints for leaks.
  6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
    - b. Option: Test concrete gravity sewer piping according to ASTM C 924.
  7. Manholes: Perform hydraulic test according to ASTM C 969.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.
- E. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- F. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

### 3.5 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 333900

## SECTION 334100 – STORM DRAINAGE

### PART 1 - GENERAL

#### 1.1 GENERAL

Furnish and install the storm drainage system as shown on the drawings.

The Contractor shall furnish and install manholes, outlet structures, trench drains, slot drains, catch basins, stormwater chambers, storm pipe, and fittings shown on the drawings.

Existing pipe and storm water structures to remain in place shall be cleaned and all debris removed shall be disposed of off site. The piping to remain in place shall be saw cut and prepared for connection with the new drainage structures and piping.

#### 1.2 STORM PIPE

- A. Scope: The Contractor shall furnish, lay and joint storm drainage pipe as shown on the drawings.

The work shall include all labor, tools, materials, and equipment including bedding and joint materials.

- B. Type of Pipe:

1. N-12 Pipe double wall HDPE as manufactured by ADS or equivalent
  - a. HDPE pipe shall have a smooth interior and annular exterior corrugations and in accordance with ASTM F2648.
2. Schedule 40 PVC.
  - a. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
  - b. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
  - c. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
  - d. Adhesive Primer: ASTM F 656.
    1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

e. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Pipe Requirements:

1. The pipe shall be accurate and of uniform dimensions. All pipe shall be straight and true to form without bulges, dents, cracks, tears, or defects which will affect strength and shall have no bulges or dents on interior surfaces which will result in a noticeable variation in diameter from that obtained on adjacent unaffected portions of the surface.
2. Only domestic materials shall be offered, provided as follows, notwithstanding any inconsistent provision of law and unless the owner shall determine it to be in consistent with public interest or the cost to be unreasonable. Only pipe manufactured in the United States shall be used on this project.
3. The contractor shall supply pipe in standard lengths.
4. Each length of pipe shall be furnished with the manufacturer's designation indicating class, size, and batch of pipe.
5. The Contractor shall supply standard manufactured fittings and adapters for all bends and differences in pipe diameters.

D. Pipe Installation:

1. All pipe shall be carefully examined for dents, cracks, and other defects, and no pipe known to be defective shall be laid. If any pipe is found to be broken or defective after being laid, it shall be removed and replaced with a sound pipe without any further payment.
2. Joint surfaces shall be protected from damage and shall be carefully examined before jointing. No damaged joints shall be used in the work.
3. Pipe shall be thoroughly cleaned and ample precautions shall be taken to prevent entrance of dirt and debris into the pipe after laying. Exposed ends of the sewer shall be provided with temporary plugs or covers.
4. All pipe shall be carefully laid to true alignment and grade. The trench bottom (6" below invert of pipe) shall be carefully graded to the proper elevation and the maximum practical solid bearing area shall be provided throughout its entire length, prior to swinging the pipe into place.
5. Care shall be taken not to excavate below grade (6" below invert). Material excavated below grade shall be replaced by material that meets with the approval of the Engineer.
6. All trenches shall be dewatered prior to laying pipe.

7. Pipe to be installed at indicated slopes free of sags and bends.
8. Install fittings for changes in direction, branch connections and changes in pipe diameter.
9. Immediately after the pipe is brought to final position, it shall be thoroughly secured and properly bedded, and ample support shall be provided to prevent settlement or disturbance.
10. Pipe shall be protected during construction against possible floatation in case the trench becomes flooded prior to placing the backfill.
11. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
12. Install sleeves for piping penetrations of walls.

E. Jointing:

1. PVC pipe jointing:
  - a. Plastic, Non-pressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - b. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - c. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.
2. HDPE pipe
  - a. Pipe shall be joined using a bell & spigot joint meeting ASTM F2648.
  - b. The joint shall be soil-tight and gaskets, when applicable, shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant supplied by the manufacturer shall be used on the gasket and bell during assembly.
3. Pipe shall be carefully jointed in conformity with the best practice and the detailed instructions of the manufacturer.
4. All pipe ends shall be thoroughly cleaned prior to and during the jointing operation.
5. At the manholes and inlet connections use flexible water stops, resilient connectors, or other flexible connections to the structures.

### 1.3 CLEANOUTS

A. Plastic Cleanouts:

1. Description: PVC body with PVC threaded plug. Include PVC storm sewer pipe fitting and riser to cleanout of same material as storm sewer piping.

## 1.4 CATCH BASINS

### A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 8-inch minimum thickness for floor slab and 6-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 6-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
5. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
6. Retain one of first two subparagraphs below if required.
7. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
8. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and grate.
9. Steps: ASTM A 615, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 36 inches.
10. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

### B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted bicycle safe drainage openings.

1. Size: 24 by 24 inches minimum unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

## 1.5 CATCH BASIN INSTALLATION

- A. General: Install catch basins, complete with appurtenances and accessories indicated.
- B. Install precast concrete catch basin sections with sealants according to ASTM C 891.
- C. Set tops of frames and covers flush with finished surface of catch basins that occur in pavements.

## 1.6 UNDERGROUND STORMWATER CHAMBERS

- A. Underground stormwater chambers are designed for stormwater management through retention and infiltration of controlled stormwater runoff. Chambers are to be Cultec Recharger V8HD units or approved equal.
- B. The chambers will be arched in shape and open-bottomed. Chambers will be joined using an interlocking overlapping rib method. Connections must be fully shouldered overlapping ribs, having no separate couplings or separate end walls.
- C. The nominal chamber dimensions shall be 32 inches tall, 60 inches wide and 8 feet long. The installed length of a chamber shall be 7.5 feet. The nominal chamber dimension of a "starter" or "end" unit shall be 32 inches tall, 60 inches wide and 5.08 feet long, with an installed length of 4.58 feet.
- D. The "intermediate" chamber units will have two side portals to accept feed connectors to create an internal manifold. The nominal dimensions of each side portal will be 10.5 inches high by 12 inches wide. The nominal chamber dimensions of the feed connectors shall be 12 inches tall, 16 inches wide and 24.2 inches long.
- E. The chambers will have discharge holes bored into the sidewalls of the unit's core to promote lateral conveyance of water.
- F. The chambers will have a raised integral cap at the top of the arch in the center of each unit to be used as an optional inspection port or clean-out.

## 1.7 SLOT SURFACE DRAIN

- A. Slot surface drain as manufactured by Duraslot or approved equal.
- B. Drain shall be manufactured from corrugated polyethylene pipe with a smooth inner wall, with pipe and fittings conforming to AASHTO M252.
- C. A grate frame that forms a slot shall be mounted in the pipe so as to provide a linear inlet into the top of the pipe to collect surface runoff. The slot shall be manufactured from .063 tempered commercial aluminum and shall have two parallel plates separated by vertical spacers spanning the slot on 6" centers.
- D. The grating within the slot opening shall be ½ - #13 galvanized steel. The slot shall be coated with a primer to protect the aluminum when installed in concrete.
- E. The flange at the bottom of the slot shall be riveted to the pipe with a minimum of two rivets per linear foot. The pipe shall have a section removed to accept the slot so as to maintain the original diameter.
- F. Cover the slot opening during construction to prevent clogging with poured concrete or asphalt. The top of the slot opening should always be set 1/8" to ¼" below finished grade. Follow manufacturer's instructions for installation.

## 1.8 MANHOLES AND STORM OUTLET STRUCTURES

- A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: As indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 8-inch minimum thickness for floor slab and 6-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36".
10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange and 26-inch diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: iron unless otherwise indicated.

## 1.9 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate reports for each system inspection.
  2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.



- c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
  - d. Infiltration: Water leakage into piping.
  - e. Exfiltration: Water leakage from or around piping.
- 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
- 4. Re-inspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
  - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
  - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  - 4. Submit separate report for each test.
  - 5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    - a. Exception: Piping with soil tight joints unless required by authorities having jurisdiction.
    - b. Option: Test plastic piping according to ASTM F 1417.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

#### 1.10 IDENTIFICATION

- A. Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
  - 1. Use detectable warning tape over ferrous piping.
  - 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

END OF SECTION 334100



## SECTION 334600 - SUBDRAINAGE

### 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. Perforated-wall pipe and fittings.
  - 2. Drainage conduits.
  - 3. Drainage panels.
  - 4. Geotextile filter fabrics.

#### 1.3 ACTION SUBMITTALS

- A. Product Data:
  - 1. Drainage conduits, including rated capacities.
  - 2. Drainage panels, including rated capacities.
  - 3. Geotextile filter fabrics.
  - 4. Weep holes, wall drains and sleeves.
- B. Related Requirements:
  - 1. Section 312001 "Earth Moving"

### PART 2 - PRODUCTS

#### 2.1 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated PE Pipe and Fittings:
  - 1. NPS 6 (DN 150) and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
  - 2. NPS 8 (DN 200) and Larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
  - 3. Couplings: Manufacturer's standard, band type.
- B. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.
- C. Wall Drains: 22 gage stainless steel tube with 22 gage removable stainless steel lower face plate and expanded stainless steel insect screen.
- D. Weep Holes: 3" diameter PVC pipe with stainless steel screen.

## 2.2 DRAINAGE PANELS

- A. Molded-Sheet Drainage Panels: Prefabricated geocomposite, 36 to 60 inches wide with drainage core faced with geotextile filter fabric.
  - 1. Products
    - a. Miradrain 6000 by Mirati, Inc.  
Norcorss, GA 30092
    - b. Hydraway 300 by Monsanto Company  
St. Louis, MO 63617
  - 2. Drainage Core: Three-dimensional, nonbiodegradable, molded PP.
    - a. Minimum Compressive Strength: 10,000 lbf/sq. ft when tested according to ASTM D 1621.
    - b. Minimum In-Plane Flow Rate: 15 gpm/ft. of unit width at hydraulic gradient of 1.0 and compressive stress of 25 psig when tested according to ASTM D 4716.
  - 3. Filter Fabric: Nonwoven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following properties determined according to AASHTO M 288:
    - a. Burst Strength (ASTM D1682): 100 lbs.
    - b. Apparent Opening Size: No. 40, maximum.
    - c. Flow (CFMC GET-2): 130 gpm/ft<sup>2</sup>
    - d. Grab Strength (ASTM D1682): 100 lbs.
    - e. Weight (ASTM D3776): 40 oz./yd<sup>2</sup>.
  - 4. Film Backing: Polymeric film bonded to drainage core surface.

## 2.3 SOIL MATERIALS

- A. Soil materials are specified in Section 312001 "Earth Moving."

## 2.4 GEOTEXTILE FILTER FABRICS

- A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft when tested according to ASTM D 4491.
- B. Structure Type: Nonwoven, needle-punched continuous filament.
  - 1. Survivability: AASHTO M 288 Class 2.
  - 2. Styles: Flat and sock.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.
- B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.

- C. Verify that drainage panels installed as part of foundation wall waterproofing is properly positioned to drain into subdrainage system.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 312001 "Earth Moving."

### 3.3 FOUNDATION DRAINAGE INSTALLATION

- A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches deep and 12 inches wide.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.
- F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
- G. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.
- H. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- I. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches (100 mm).
- J. Install drainage panels on foundation walls as follows:
  - 1. Coordinate placement with other drainage materials.
  - 2. Lay perforated drainage pipe at base of footing. Install as indicated in Part 3 "Piping Installation" Article.
  - 3. Separate 4 inches of fabric at beginning of roll and cut away 4 inches of core. Wrap fabric around end of remaining core.
  - 4. Attach panels to wall beginning at subdrainage pipe. Place and secure molded-sheet drainage panels, with geotextile facing away from wall.
- K. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

### 3.4 UNDERSLAB DRAINAGE INSTALLATION

- A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for underslab subdrainage.
- F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
- G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Install horizontal drainage panels as follows:
  - 1. Coordinate placement with other drainage materials.
  - 2. Lay perforated drainage pipe at inside edge of footing.
  - 3. Place drainage panel over drainage pipe with core side up. Peel back fabric and wrap fabric around pipe. Locate top of core at bottom elevation of floor slab.
  - 4. Butt additional panels against other installed panels. If panels have plastic flanges, overlap installed panel with flange.

### 3.5 RETAINING-WALL DRAINAGE INSTALLATION

- A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches.
- C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- D. Install drainage piping as indicated in Part 3 "Piping Installation" Article for retaining-wall subdrainage.
- E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
- F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.
- G. Place drainage course in layers not exceeding 3 inches in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.

- H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.
- I. Install drainage panels on wall as follows:
  - 1. Coordinate placement with other drainage materials.
  - 2. Lay perforated drainage pipe at base of footing as described elsewhere in this Specification. Do not install aggregate.
  - 3. If weep holes are used instead of drainage pipe, cut 1/2-inch-diameter holes on core side at weep-hole locations. Do not cut fabric.
  - 4. Mark horizontal chalk line on wall at a point 6 inches less than panel width above footing bottom. Before marking wall, subtract footing width.
  - 5. Separate 4 inches of fabric at beginning of roll and cut away 4 inches of core. Wrap fabric around end of remaining core.
  - 6. Attach panel to wall at horizontal mark and at beginning of wall corner. Place core side of panel against wall. Use concrete nails with washers through product. Place nails from 2 to 6 inches below top of panel, approximately 48 inches apart. Construction adhesives, metal stick pins, or double-sided tape may be used instead of nails. Do not penetrate waterproofing. Before using adhesives, discuss with waterproofing manufacturer.
  - 7. If another panel is required on same row, cut away 4 inches of installed panel core and wrap fabric over new panel.
  - 8. If additional rows of panel are required, overlap lower panel with 4 inches of fabric.
  - 9. Cut panel as necessary to keep top 12 inches below finish grade.
  - 10. For inside corners, bend panel. For outside corners, cut core to provide 3 inches for overlap.
- J. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

### 3.6 LANDSCAPING DRAINAGE INSTALLATION

- A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least 6 inches between conduit and trench walls. Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with adhesive or tape.
- E. Add drainage course to top of drainage conduits.
- F. After satisfactory testing, cover drainage conduit to within 12 inches of finish grade.
- G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

- I. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

### 3.7 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
  1. Foundation Subdrainage: Install piping level and with a minimum cover of 36 inches unless otherwise indicated.
  2. Underslab Subdrainage: Install piping level.
  3. Plaza Deck Subdrainage: Install piping level.
  4. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping level and with a minimum cover of 36 inches unless otherwise indicated.
  5. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches unless otherwise indicated.
  6. Lay perforated pipe with perforations down.
  7. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
- B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- C. Install thermoplastic piping according to ASTM D 2321.

### 3.8 PIPE JOINT CONSTRUCTION

- A. Join perforated PE pipe and fittings with couplings according to ASTM D 3212 with loose banded, coupled, or push-on joints.
- B. Join perforated PVC sewer pipe and fittings according to ASTM D 3212 with loose bell-and-spigot, push-on joints.
- C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

### 3.9 BACKWATER VALVE INSTALLATION

- A. Comply with requirements for backwater valves specified in Section 334100 "Storm Utility Drainage Piping."
- B. Install horizontal backwater valves in header piping downstream from perforated subdrainage piping.
- C. Install horizontal backwater valves in piping in manholes or pits where indicated.



### 3.10 CLEANOUT INSTALLATION

- A. Comply with requirements for cleanouts specified in Section 334100 "Storm Utility Drainage Piping."
- B. Cleanouts for Foundation, Retaining-Wall, and Landscaping Subdrainage:
  - 1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
  - 2. In vehicular-traffic areas, use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches deep. Set top of cleanout flush with grade.
  - 3. In nonvehicular-traffic areas, use NPS 4 [cast-iron] [PVC] pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches deep. Set top of cleanout [1 inch] [2 inches] above grade.
  - 4. Comply with requirements for concrete specified in Section 321614 "Concrete Site Work."
- C. Cleanouts for Underslab Subdrainage:
  - 1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
  - 2. Use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

### 3.11 CONNECTIONS

- A. Comply with requirements for piping specified in Section 334100 "Storm Utility Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect low elevations of subdrainage system to[ building's] solid-wall-piping storm drainage system.
- C. Where required, connect low elevations of [foundation] [underslab] (WG To VERIFY REQUIREMENTS) subdrainage to stormwater sump pumps.

### 3.12 IDENTIFICATION

- A. Arrange for installation of green warning tapes directly over piping. Comply with requirements for underground warning tapes specified in specified in Section 312000 "Earth Moving."
  - 1. Install PE warning tape or detectable warning tape over ferrous piping.
  - 2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

### 3.13 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.

2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
- B. Drain piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

#### 3.14 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 334600

## SECTION 334611 – BIORETENTION AND DRY SWALE SOIL

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. This work shall consist of installing Bioretention and Dry Swale Soil in accordance with the documents and as directed by the Engineer. The work shall also consist of having the Bioretention and Dry Swale Soil tested for total soil phosphorus concentration at a qualified laboratory. A qualified laboratory shall be defined as a laboratory that is certified by the New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) to test soil for total soil phosphorous.

#### 1.2 MATERIALS

- A. The soil for Bioretention areas and Dry Swales shall be a uniform mix, free of stones, stumps, roots or other objects larger than 50 mm in diameter. The Bioretention and Dry Swale soil shall be visibly free of noxious weeds.
- B. Bioretention and Dry Swale Soil shall be a well blended mixture of three (3) parts sand and one (1) part topsoil, by volume. Sand shall meet the requirements of 703-07 *Concrete Sand*. Topsoil shall be in accordance with the requirements of 713-01 *Topsoil* for Topsoil Type A, except as follows:
  - 1. All topsoil shall be sampled and tested, regardless of the source.
  - 2. Sampling of topsoil, amended topsoil, and the Bioretention and Dry Swale Soil shall be done by the Contractor/Supplier. Sampling protocol shall be in accordance with 713-01 *Topsoil*.
- C. The Bioretention and Dry Swale Soil shall have a pH range of 5.2 to 7.6 and an organic content of 3-7%. Soil amendments to increase organic content shall be peat moss in accordance with 713-15 *Organic Material*.
- D. Acceptance of Bioretention and Dry Swale soil will be based upon a material certification that the material conforms to the above requirements. The Contractor/Supplier shall provide to the Engineer copies of testing results of the sand gradation, topsoil gradation, organic content percentage of the Bioretention and Dry Swale Soil, and pH of the Bioretention and Dry Swale Soil. These tests are to be paid under the Bioretention and Dry Swale Soil item.
- E. The Contractor shall provide to the Engineer copies of testing results for Soil Phosphorus Concentration. Samples to be submitted to the qualified laboratory shall be obtained in accordance with 713-01 *Topsoil*. Sampling shall be paid under the pay item for Bioretention and Dry Swale Soil. The results of the Soil Phosphorus analysis shall not be used as the basis for material acceptance.
- F. Sampling frequency for total phosphorous shall be one composite sample for the first 75 to 375 cubic meters of soil, and an additional composite sample for each additional 375 cubic meters, or portion thereof. No samples are required for stockpiles of less than 75 cubic meters.

### 1.3 CONSTRUCTION DETAILS

- A. Bioretention and Dry Swale Soil shall be installed at the locations and to the depth(s) as shown in the contract documents. Placement of Bioretention and Dry Swale Soil shall be done in lifts of 300 mm to 450 mm. The soil shall be loosely compacted, such as by tamping lightly with a dozer or backhoe bucket. No other materials or substances shall be mixed or dumped within the Bioretention area and Dry Swale that may be harmful to plant growth or prove a hindrance to planting or maintenance operations.

### 1.4 METHOD OF MEASUREMENT

- A. For Bioretention and Dry Swale Soil, this work will be measured as the number of cubic meters of Bioretention and Dry Swale Soil installed, computed from payment lines shown in the contract documents.
- B. For Laboratory Testing for Soil Phosphorus Concentration, this work will be measured by the number of soil samples analyzed by the qualified laboratory for Soil Phosphorus Concentration.

### 1.5 BASIS OF PAYMENT

- A. The unit price bid for Bioretention and Dry Swale Soil shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work, including costs for testing.
- B. For Laboratory Testing for Soil Phosphorus Concentration, the Contractor will be reimbursed for the receipted costs of testing plus 5% for profit and overhead. "Testing" includes the cost of the laboratory test(s) and all labor, materials and equipment required to obtain and deliver soil sample(s) to the qualified laboratory.

END OF SECTION 334611